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THE RELATIONSHIP BETWEEN WORD FLUENCY AND READING COMPREHENSION

by

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A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF EDUCATION

DEPARTMENT OF ELEMENTARY EDUCATION

EDMONTON, ALBERTA
APRIL, 1966

ABSTRACT

The present study investigates the relationship between reading comprehension and word fluency in an attempt to determine certain perceptual and cognitive dimensions of reading.

Research has indicated that reading involves a perception of words and a perception of the pattern in which they are arranged. The perception of the words results in divergent associations and the perception of the pattern results in the selection of relevant associations and leads the reader into the convergent process of synthesis. Research has also suggested that word fluency is the ability to produce words when such restrictions as word length are imposed. The present study hypothesizes that the imposing of few restrictions makes the task more divergent in nature and the imposing of many restrictions makes the task more convergent.

Specifically it was hypothesized that

I. There is a convergent and a divergent factor in word fluency.

II. There is a significant relationship between the scores of grade ten female students on tests of divergent word fluency and on tests of reading comprehension.

III. There is a significant relationship between the scores of grade ten female students on tests of convergent word fluency and on tests of speed of reading comprehension.

IV. There is a significant relationship between the scores of grade ten female students on tests of convergent word fluency and on tests of level of reading comprehension.

V. There is no significant relationship between the scores of grade ten female students of divergent word fluency and on tests of level of reading comprehension.

To test the hypotheses the Co-operative Reading Test, Form Z and fluency tests devised and validated in a pilot study were administered to 250 grade ten female students. The fluency tests were analyzed by a principal axes factor analysis followed by an equamax analytic rotation. Partial correlation and analysis of variance were used to determine any existing relationship between the word fluency and reading comprehension factors.

The results, confirmed the first three and last hypotheses, but not the fourth. There was clear evidence of a convergent-divergent dimension in word fluency and of a significant relationship between speed of comprehension and both word fluency factors. No significant relationship was found between the word fluency factors and level of comprehension. These findings indicate that the perception and manipulation of structure is positively correlated with speed of comprehension but is not significantly correlated with depth of comprehension. This study also suggests that investigations into the relationship of the other verbal fluency factors and reading comprehension might prove to be a useful technique in gaining more precise information as to the factors involved in reading comprehension.

ACKNOWLEDGEMENTS

The author acknowledges her thanks and appreciation to Dr. M. E. Jenkinson (Thesis Chairman) for her guidance and critical evaluation. Particular thanks also goes to my thesis committee Miss D. M. Lampard and Dr. G. M. Farmer for their suggestions and criticisms. I also wish to express my appreciation to the Edmonton Separate School Board and the St. Paul School Board without whose co-operation this study would not have been possible. Thanks also goes to those teachers and other personnel who assisted in the collection and analysis of the data.

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CHAPTER I

THE PROBLEM

The present research is an attempt to determine some of the dimensions involved in reading comprehension. It is suggested that reading is concerned with depth and accuracy of understanding as well as the speed with which such depth and accuracy is gained. It would seem that facility in the perception and manipulation of ideas would be highly correlated with reading ability. However, it may be that a perception of the way in which words, sentences, and paragraphs are arranged in a passage is a means of gaining a more complete perception of the ideas. Whether such an awareness of structure relates more closely to depth or to speed of comprehension is a moot question. The present study begins research into this area by investigating the relationship between reading comprehension and the ability to produce words according to structural limitations. Obviously, facility in the perception of word structure is only one small factor in the complex of reading comprehension. However, if relationships between the perception of word structure and reading comprehension can be demonstrated, insight might be gained as to the relationship between structure and both speed and level of reading comprehension. This in turn might give some indication as to the nature of the processes involved in reading comprehension.

Background of the Study

Reading comprehension has been conceived of as an ability to derive meaning from the printed page. Specifically, it involves the ability to interact appropriately with small units such as words as well as larger units such as phrases, sentences and paragraphs. The reading process demands a perception of these words or larger units, the production of associations, the selection of the relevant ones and a synthesis of these to produce meaning. This indicates that reading involves a divergent production of calling up associations and a convergent production of selecting and synthesizing the relevant ones. Any word calls up a number of associations, but the word is limited in its meaning by the sentence and passage in which it is used. Similarly, a sentence and even an entire paragraph may be restricted in meaning by its context. Thus the meaning of a passage is partially gained by the meaning of the words themselves and partially by their arrangement in a specific structure. This would imply that reading demands an ability to perceive ideas, but also an ability to limit and arrange these ideas according to the structure of the entire passage. Good reading comprehension demands a high ability in all these areas. To measure such ability both level and speed of comprehension must be considered. This involves an evaluation of the accuracy and depth of the meaning derived as well as the speed of understanding.

The above would suggest that there may be many factors which would have influence on or correlate highly with speed and level of comprehension. Intelligence, age, and grade level are obviously such influences. Perhaps,

verbal fluency may also be a relevant factor.

Verbal fluency is usually considered to be an ability to produce a quantity of words or ideas quickly and would appear to be subdivided into specific abilities. For example, word fluency is usually characterized by an ability to produce words according to structural limitations but with minimal regard for meaning. In contrast, associational fluency is generally considered to be an ability to produce a quantity of words all related in meaning. Both of these types of verbal fluency demand the production of single words; however, ideational and expressional fluency are usually understood to demand the production of larger units. Ideational fluency is commonly characterized as the ability to produce a quantity of ideas quickly and expressional fluency the ability to express the same idea in a number of different ways. Thus, verbal fluency seems to be subdividied into the ability to produce word units according to either meaning or structure and the ability to produce either words or larger units. Since all these types of verbal fluency emphasize a quantity of production in a short period of time, it would appear that processes of association are involved. However, to the extent that only certain associations are relevant there is also a type of selection and synthesis demanded. This may suggest a convergent-divergent dimension to verbal fluency.

The above would indicate that ability in either reading comprehension or verbal fluency demands ability in a number of smaller tasks. However, a comparison of the dimensions of the tasks involved in reading comprehension and those involved in the various types of verbal fluency reveal striking similarities.

Presumably, the production of ideas demanded in ideational fluency would relate to the perception of ideas demanded in reading comprehension. Again, the production of words according to structural limits would seem to have similarities to the perception of structure in reading comprehension. Thus, it would seem logical to suggest that there may be a correlation between certain aspects of reading comprehension and certain types of verbal fluency.

The major difficulty in any investigation into this relationship is the difficulty of isolating the various aspects of reading comprehension. However, if one could demonstrate that there is a correlation between one of the verbal fluency factors and the total complex of reading comprehension, one could then hypothesize with some certainty that the abilities needed for that verbal fluency factor are also needed for reading comprehension. The question of which of the verbal fluency factors to choose for the initial investigation is thus posed.

In the discussion of reading, it was held that a perception of structure may be one means of gaining a perception of ideas; however, it was unclear whether facility with structure is primarily related to the level or speed of reading comprehension. Therefore, it would be of decided value to determine the relationship of both speed and level of reading comprehension to the ability to produce words according to structural limits (word fluency). Results from such a study would be likely to indicate whether facility in producing words within a structure is relevant to reading comprehension; and if it is relevant, whether it is primarily related to speed or to depth of comprehension. Thus, it would seem reasonable to begin

research into the relationship between verbal fluency and reading comprehension by determining the relationship between reading comprehension and the specific verbal fluency factor of word fluency. A further justification for beginning research in this area is that word fluency would appear to be the most clearly delineated and most easily testable of the verbal fluency factors.

As previously mentioned, word fluency is usually understood as an ability to produce words according to structural limitations but with minimal regard for meaning. If the structural limitations are at a maximum, the task tends to become one of word closure and synthesis. Here convergent abilities would appear to be involved. If the structural limitations are at a minimum, the task becomes one of association, and divergent production would seem to be demanded. Thus, a convergent-divergent dimension to word fluency can be suggested. Since both convergent and divergent word fluency are concerned with the speed of production, it is logical to suggest that both types of word fluency may relate more closely to speed of comprehension than to level of comprehension. However, convergent word fluency would seem to demand abilities to select the relevant and to make appropriate closure. This would seem to suggest a relationship between convergent word fluency and level of comprehension.

Purpose of the Study

The purpose of the present study is to investigate the truth of the above conclusions; that is, to determine whether word fluency has a convergent-

divergent dimension and to determine the relationship between both these aspects of word fluency and speed and level of reading comprehension. If such relationships can be shown, a fruitful way of gaining more information about the nature of reading comprehension may be revealed.

Definition of Terms

For the purposes of this study these terms are conceived as follows:

Level of Comprehension - a measure of the degree of complexity of ideas that a person can accurately perceive in written discourse and then recall for the answering of multiple choice questions. This is level of comprehension as measured by the Co-operative Reading Test.

Speed of Comprehension - a measure of the speed with which a person can accurately perceive and recall ideas in written discourse for the answering of multiple choice questions. This is speed of comprehension as measured by the Co-operative Reading Test.

Word Fluency - the ability to produce in writing, words according to structural limitations but with minimal regard for meaning. This factor is conceived as having two aspects as follows:

Divergent word fluency - the ability to produce words in writing when minimum limitation is placed on both meaning and structure.

Convergent word fluency - the ability to produce words in writing where minimum limitation is placed on meaning and maximum restriction on structure.

Hypotheses

To investigate the nature of word fluency and its relationship to the reading comprehension factors the following hypotheses were formulated:

I. There is a convergent and divergent factor in fluency.

II. There is a significant relationship between the scores of grade ten female students on tests of divergent word fluency and on tests of speed of comprehension.

III. There is a significant relationship between the scores of grade ten female students on tests of convergent word fluency and tests of speed of comprehension.

IV. There is a significant relationship between the scores of grade ten female students on tests of divergent word fluency and on tests of level of comprehension.

V. There is a significant relationship between the scores of grade ten female students on tests of convergent word fluency and on tests of level of comprehension.

Plan of the Study

To test the above hypotheses word fluency tests had to be specifically designed for this study. Previous research on word fluency was examined, and from the tests used in these studies, particular ones were selected and similar ones devised. These tests were then administered in a pilot study and a battery of word fluency tests obtained.

The I.P.A.T. Culture Fair Intelligence Test was administered to obtain an estimate of intelligence which was then controlled through statistical adjustment. These word fluency tests and the Co-operative Reading Test were administered to grade ten female students. Other variables such as age, sex, grade and personality were controlled by the selection of the sample and by randomizing procedures. The tests were administered to 250 subjects and appropriate statistics were applied to the resulting scores.

Limitations of the Study

Only grade ten female students were used in this study and therefore any results cannot be generalized to other ages, grades or sex. Further, since students scoring either extremely high or extremely low in reading were eliminated from the analyses of variance, the results here can apply to only the average reader. In any study of this relationship, the variables which influence or correlate with verbal fluency will have to be controlled or randomized. The most important of these is personality. It should also be noted that the present study deals only with the written dimension of word fluency and makes no attempt to investigate the oral aspect.

CHAPTER II

RELEVANT RESEARCH

Since the present study deals with the relationship between word fluency and reading comprehension, and since word fluency is one part of verbal fluency, it is necessary to determine the dimensions of both verbal fluency and reading comprehension before any hypotheses can be formulated as to the relationship between the two. Thus, the following outlines the relevant research in each of these areas as well as providing a theoretical background for the synthesis.

Verbal Fluency

Verbal fluency is usually considered to be a mental ability to produce a quantity of words or ideas quickly and its existence has been confirmed by a number of studies (3, 6, 15, 21, 30, 39). In 1927 Hargreaves (27) indicated that imagination had an originality and a fluency factor, the latter being characterized by speed and quality of production. However, later studies have emphasized speed rather than quality of production.

Relationship of Other Factors to Verbal Fluency

Of the factors which may influence or correlate with verbal fluency the most important seems to be personality. Galton (18) as early as 1883 indicated his belief that verbal fluency had a tempermental dimension. Cattel (7, 8) has shown that verbal fluency is closely related to the trait of surgency and Rogers (38)

that there is a high correlation between verbal fluency and extroversion, with oral facility being related to surgency and written facility to dominance. These and other studies (11, 36, 37) would indicate a high correlation between verbal fluency and personality. Related to this would be sex differences in fluency. As studies (16, 33) have shown that girls demonstrate superior reading ability, it would seem reasonable to suggest that they might also demonstrate superior verbal fluency. In most of the studies on verbal fluency, sex has not been treated as a relevant variable. Thus, there is no clear indication as to the existence or non-existence of sex differences. However, Woodrow (48) failed to demonstrate any significant difference between the performance of males and females on verbal fluency tasks.

A second group of factors may affect verbal fluency by inhibiting it. Since verbal fluency is measured as a speed factor, an individual's score would be greatly affected by any interference effect. The existence of inhibiting factors have been suggested by a number of studies (5, 27). For example, Hofstaetter, O'Conner and Suziedelis (27) showed that the larger the number of ideas that one possesses the slower the rate of production. Closely related is a study of perseveration by Notcutt (35). Results here give no indication of perseveration except in motor tasks. It seems clear that whereas there may be an interference effect between speed and number of responses available, this effect does not seem to be due to perseveration. Thus, verbal fluency appears to be highly correlated with certain personality traits and may be related to sex differences. Further, there seems to be an interaction between an individual's store of ideas

or words and the speed with which he can produce them.

Dimensions of Verbal Fluency

This consideration of speed raises the issue of the relationship between an individual's verbal fluency score and his speed of writing or speed of articulation. Rogers (39) has demonstrated the existence of an oral and a written verbal fluency factor, but failed to demonstrate any close relationship between these fluency factors and speed of articulation or speed of writing. This study does, however, indicate that verbal fluency has an oral and a written dimension.

A number of other attempts have been made to map out the dimensions of verbal fluency (3, 6, 15, 21, 39). Initially, the verbal fluency factor was conceived of as a word fluency factor (18, 28, 45). Later Carrol (6) found that this verbal fluency seemed to split into two factors, one where there is a clear restriction on the number of responses which would be considered correct, and the other, where the production of meaningful and coherent discourse is emphasized. Fructer (15) identified three verbal fluency factors as: fluency dealing with simple words, fluency of association for common words where there is some restriction placed on response, and fluency dealing with the production of syntactically coherent discourse. Bereiter (3) as well as Guilford and Christensen (21) have divided this third fluency factor into one which demands the production of a quantity of ideas and one which demands the production of a variety of ways in which to express the same idea. This suggests that there are

four major divisions of the verbal fluency factor. Guilford and Christensen (21) identify these as word fluency, ideational fluency, associational fluency, and expressional fluency (verbal versatility). Word fluency appears to be the ability to produce words according to specific structural limitations but with little regard for meaning. Conversely, associational fluency appears to be the ability to produce words with restrictions as to meaning but none as to structure. Ideational fluency is usually understood as an ability to produce a quantity of ideas, and expressional fluency the ability to express the same idea in a number of different forms. Thus, both word and associational fluency deal with the production of single words whereas ideational and expressional fluency deal with larger units. Again, both associational and ideational fluency are concerned with the production of ideas, and therefore the tasks concerned are conceptual in nature. Conversely, both word and expressional fluency are concerned with the form in which the idea is expressed; that is the structure of the word, phrase, sentence or paragraph. This means that verbal fluency may be conceived as follows:

Figure 1 -- Dimensions of Verbal Fluency

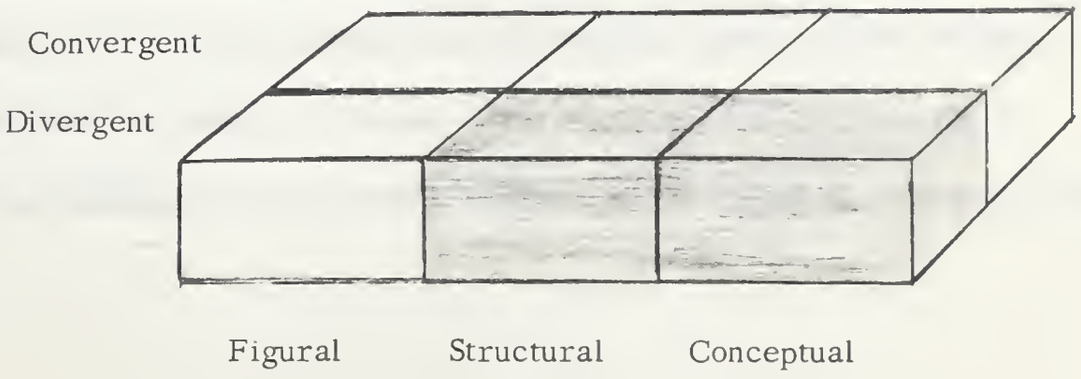
Words	Word Fluency	Associational Fluency
Larger Units	Expressional Fluency	Ideational Fluency
	Structural	Conceptual

Guilford's Structure of the Intellect Related to Verbal Fluency

As Guilford (22, 23) indicates that verbal fluency is one aspect of human intellect, an understanding of his theoretical framework may be useful in generating hypotheses about verbal fluency. Guilford (23) indicates that the intellectual factors fall into two main divisions, those of 'memory' and those of 'cognition'. The latter from the majority and can be divided into the elements of cognition, production, and evaluation. Cognition refers to an understanding of a stimulus situation, production refers to a response to the situation, and evaluation to a judgment regarding the response.

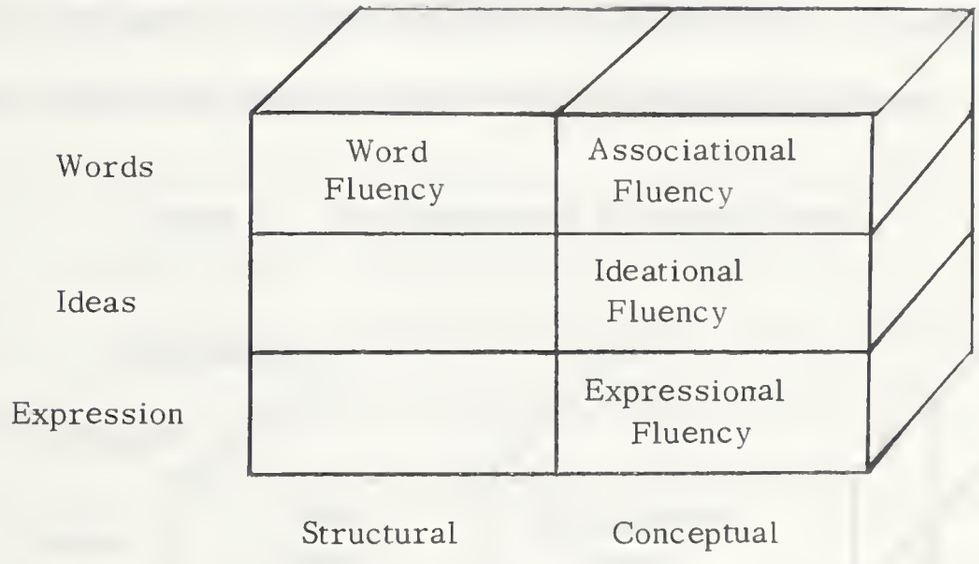
The production factor can be subdivided into figural, structural, and conceptual types of content. Figural content is concerned with form itself, structural content with the form of an idea, and conceptual content with an idea itself. A further subdivision is the divergent-convergent dimension. Divergent thinking demands a wide range of responses to a stimulus and is largely a free association process. Convergent thinking demands a synthesis of the many elements into a meaningful whole. Thus, Guilford (23) conceives of the production factor having the following dimensions:

Figure 2 -- The Production Factor



Guilford (22) then goes on to suggest that verbal fluency relates to the divergent dimension and to structural and conceptual content; that is the shaded part of figure 2. The following figure shows Guilford's placement of the verbal fluency factors within these dimensions.

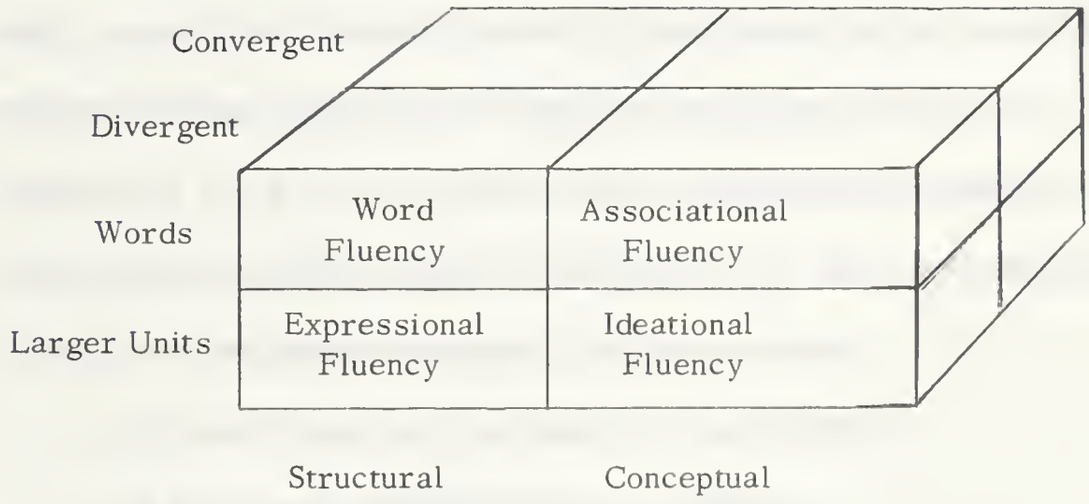
Figure 3 -- The Relationship of Verbal Fluency to the Production Factor



The present study uses the above theoretical framework but makes certain alterations for the following reasons. Guilford's distinction between words and ideas is really one of the size of the thought unit and may be more clearly understood as a dimension of words and larger units. Further, Guilford places expressional fluency in the conceptual dimension but an examination of this factor reveals that expressional fluency is the structuring of larger units in a variety of forms. This would suggest that it is more likely to be relevant to the structural rather than the conceptual dimension and

could really be better placed in that domain. Again, Guilford clearly conceives of fluency as a divergent ability demanding a great deal of facility in producing associations. However, as each association must be evaluated for relevance, it would seem reasonable to suggest that fluency may also have a convergent dimension. The more severe the restriction on the response, the greater would be the demand on convergent abilities. Thus, the present study suggests a convergent-divergent dimension to verbal fluency. The above would indicate that verbal fluency would have the following dimensions:

Figure 4 -- The Dimensions of Verbal Fluency



The present study investigates one aspect of this complex of verbal fluency. It attempts to determine the relationship between reading and word fluency. Because of the above theoretical framework, word fluency is conceived as dealing with structural production and having a convergent-divergent dimension.

Word Fluency

This factor of word fluency was first identified by Thustone (45) as one of the nine primary mental abilities and was defined as the ability to handle simple isolated words without regard for meaning. The major tests with high loadings on this factor were anagrams, disarranged words, first and last letters, spelling, and grammar. Thurstone's matrix was later factored by Eysenck (13) and again by Holzinger and Harman (28). Holzinger and Harmon (28) obtained a word fluency factor measured by anagrams, disarranged words and first and last letters. Eysenck (13) obtained a factor called "verbal linguistics" identified by the same three tests. It seems reasonable to suggest that these are merely different names for the same factor and that the three specified tests are clear measures of this factor. Later research (3, 6, 15, 21, 31, 39) has clearly confirmed the existence of word fluency and shown other tests to be indicators of it. Such tests demand the production of words with structural limitations such as:

(a) words beginning or ending with a certain letter.

(b) words with certain prefixes or suffixes.

(c) words of a specified length.

(d) words containing specified letters.

(e) anagrams.

(f) disarranged words.

Thus, word fluency is a well established factor with certain tests being considered reliable measures of it.

A close examination of the tasks demanded by these tests reveals differences in the degree of association and synthesis required. In some tests, a large number of associations are required with little restriction as to the nature of the response. Such a test would be to write as many words starting with 'q' as one can in a two minute period. In tests of this type there are a large number of correct responses, and ability in this area is measured by the number of responses made. Because of the emphasis on a variety of associations, these tests would appear to measure ability in divergent production. However, it is also possible to demand the production of words according to such heavy structural limitations that only one or a minimum number of responses are correct. Disarranged letters (g, w, i, n) which have to be rearranged to make a single word (wing) would be an example of this. Here, there is close to a one to one correspondence between the stimulus and response. Thus, the number of stimuli that a person could deal with effectively within a specified time limit would be a measure of his ability in this area. In these tests some association is required, but the emphasis is on a selection of the relevant response. Therefore, a synthesizing ability is demanded and the convergent aspect becomes more important. The above suggests that the tests of word fluency could be arranged along a convergent-divergent continuum according to the amount of restriction that is involved.

Thus, word fluency is an intellectual factor tested by requiring a subject to produce words according to certain structural limitations. It is held

by Guilford that word fluency is an aspect of divergent product, but the present study postilates that it may also have a convergent dimension.

Reading

There is little agreement as to the exact nature of reading comprehension but certain basic tenets seem well established. It has long been agreed that reading demands more than the acquisition of facts and details by a simple additive process. Dewey (12) indicated the ability to find facts differs from the ability to draw inferences and understand the significance of what is read. Using material from Zoology, Tyler (46) found marked differences in students' abilities to find facts and in their ability to draw inferences. Bedell (2) again showed that there were marked discrepancies in students' ability to recall specific information in general science and their ability to do inferential thinking in the same area. Thorndike (42, 43) indicated that reading is a thinking process and that the pupil needs the right mental set to achieve adequate comprehension. Again Young (49) indicated that the chief element in reading is thinking. Ledbetter (34) indicated the importance of conceptual abilities and concluded that obtaining concepts presents more difficulty to the average student than does vocabulary, sentence length or sentence structure. Gates (17) demonstrated that the most important predictor of success in reading was the ability to grasp the substance of a story. Thus, it is clear that reading is not an accumulation of specific details but a thinking process

which demands an integration and interpretation of these specifics.

In more detail Artley (1) concluded that "reading comprehension in Social Studies demands the ability to obtain facts, to organize and to interpret." Johnson (31) suggested that "reading involves seeing relationships between words and ideas, evaluating an author's statements, drawing inferences, developing a problem, and adjusting the type of reading to a purpose." Davis (10) indicated that the major skills basic to reading comprehension are: "knowledge of word meaning, ability to select the appropriate meaning for a word or phrase in the light of its particular contextual setting, ability to follow the organization of a passage and to identify antecedents and references to it, ability to select the main thought of a passage, ability to answer questions which are specifically answered in a passage but not in words in which the question is asked, ability to draw inferences from a passage about its contents, ability to recognize the literary devices in a passage and to determine its tone and mood, ability to determine a writer's purpose, intent and point of view."

Perhaps the clearest indication of the processes involved in comprehension come from Bloom (4) and Gray (34). Bloom indicates that comprehension in reading or in other areas involves translation, interpretation, and extrapolation. The initial act is recoding the passage to a form which is familiar to the reader. This involves not only giving meaning to the various parts of the passage taken in isolation, but also limiting this meaning to the context in which the ideas appear. Having translated the passage into an easily accessible form, the reader is prepared to interpret it. This means

a reordering of the ideas into a new configuration in the mind of the individual and includes an understanding of the relative importance of the ideas, of the interrelationship of the ideas, and of the relevance of the ideas to generalizations implied or described in the original communication. The reader is now ready for extrapolation. This means the making of predictions based on an understanding of the trends, tendencies or conditions described in the passage. It can also involve the making of inferences with respect to implications, consequences and corollaries which are in accordance with the passage. Gray (24) indicates that reading starts with the printed word and moves through word perception to comprehension. Comprehension involves grasping the literal meaning of the passage and going on to make valid generalizations and interpretations. The reader then reacts to the passage, and thus, evaluates what he has read. Finally, the reader fuses these new ideas with previous experience.

In the light of this research, the act of reading can be conceived as follows: the initial act is one of a perception of a word, phrase, or larger unit which calls up associations in the reader's mind. A word in isolation produces associations in the reader's mind, but as soon as the word is put into a phrase or a sentence its meaning is limited. Similarly, the meaning of any phrase or sentence is limited by the rest of the paragraph and in turn the meaning of the paragraph is limited by the meaning of the entire passage. Thus, words or phrases call up a variety of associations: but these are limited by the context of the rest of the passage and therefore, only certain

associations are relevant. This means that a reader must be aware of the possible meaning of word units as well as the limitations imposed by the particular arrangement of the word units within a passage. Thus, words or phrases call up a variety of associations but the relevance of these associations are determined by the structure of the entire passage. To comprehend a passage the reader must then synthesize these associations into a meaningful whole. To do this he uses clues from the passage and from previous experience. Having thus attained a gestalt of the entire passage, he should be able to make generalizations and go beyond the stated meanings to make inferences and interpretations. If a reader does not have sufficient background experiences to produce the needed associations, he fails to comprehend. Again, a student may be able to produce any number of responses; but if he cannot select the relevant ones and synthesize them in such a way as to produce meaning, he has again failed to understand. Thus, comprehension seems to involve the divergent production of associations and the convergent production of selection and synthesis. The divergent process would seem to depend on a type of fluency with words whereas the convergent process would seem to depend on type of fluency with structure. Presumably, the complexity of ideas that an individual can perceive in written discourse and then recall and use is an indication of his depth of comprehension. Similarly, the speed with which these processes occur gives a measure of an individual's speed of reading.

Conclusion

Research has shown that verbal fluency is a mental ability not only concerned with the speed and versatility of the association process, but also with the ability to select relevant and reject irrelevant responses. From this understanding and from Guilford's theories on the structure of the human intellect a convergent-divergent dimension can be hypothesized. Further, certain types of verbal fluency emphasize meanings and concepts while others emphasize the structure of a word, phrase, or passage; this suggests a structural-conceptual dimension. Again, a division is made between the types of verbal fluency which demand the production of single words and those that demand the production of larger units. Thus, verbal fluency is conceived as having a convergent-divergent dimension, a structural-conceptual dimension, and a size of unit dimension.

Word fluency is understood to have a convergent-divergent dimension and to be concerned with the structural dimension, and with the production of single words. Thus, word fluency demands facility in producing words according to specified structural limitations.

It has also been shown that reading comprehension depends on the skill with which a person can perceive words and structure, call up associations, select the relevant ones, and synthesize these into a meaningful whole. The abilities required in this process of reading comprehension would appear to be similar to those required in word fluency. Therefore, it is logical to suggest that there would be a relationship between word fluency and reading

comprehension. Since word fluency is a measure of the speed of structural production, it is expected that word fluency would relate more closely to speed than to depth of comprehension. Nevertheless, convergent production would appear to be related to the synthesis necessary for accuracy in reading, and therefore, it is thought that convergent word fluency should have more relevance to depth of comprehension than would divergent word fluency.

Of particular interest is a study by Johnston and Reynolds (30), who have based their research on the belief that there are two fundamental processes in problem solving, one process being the recalling and production of responses and a second process being the selection of the relevant responses. They showed that the verbal fluency factor could be split into these two dimensions, and claim that this would account for a large share of the variance found in previous research on verbal fluency. This division obviously has similarities with Guilford's convergent-divergent dimension and with the process of association and synthesis required in reading. In this connection, it is interesting to note that this study found that the Nelson-Denny Reading Test showed approximately equal weightings on each of the factors of flow and selection and that in each case the loading of reading on the factor was high. This study clearly gives support to the hypothesized relationship between the two word fluency factors and speed and level of comprehension.

CHAPTER III

THE EXPERIMENTAL DESIGN

This study was designed to investigate the relationship between word fluency and reading comprehension. To measure these variables, a standardized reading test and word fluency tests especially designed for this study were administered to a carefully selected sample. Variables such as age, sex, and grade were controlled by the initial choice of sample; others such as personality were assumed to be randomly distributed throughout the sample; and intelligence was measured by a standardized non-verbal intelligence test and its effect statistically removed. Uniform administrative and scoring procedures were used and the resulting scores treated with appropriate statistics to determine any existing relationship between the major experimental variables of word fluency and reading comprehension

Sample

The population for this study was all grade ten female students attending separate high schools in Edmonton. Two groups were randomly selected from this population. The first consisted of 150 subjects and the second 100. As the use of two groups rather than one is more likely to produce a random sample, the two groups were combined. In this study, grade ten students were used because pupils of this grade appear to have reached some stability in word fluency. The pilot study revealed no significant differences between the scores

of grade eight, ten and eleven students. Although the pilot study did not reveal any sex difference on word fluency scores, there was evidence that a female population showed more variability in word fluency. Thus, a female population was selected for the present research.

Testing Instruments

Reading Test

Form Z of the Co-operative Reading Test was used. This test is based on a "belief that reading comprehension is essentially a thinking process, a process which requires mental facility in manipulating verbal concepts, a background of experience, and skill in the specialized techniques of reading comprehension." (9) The following comprehension abilities are purported to be measured:

(a) determining the meaning of words from contextual clues

(b) organizing meanings

(c) construing the writer's meaning

(d) drawing conclusions from the context

The composite of a student's scores on the above tasks taken over the first thirty questions, indicates his level of comprehension. The number of questions that he can complete correctly within a given time limit shows his speed of comprehension. Since a total of twenty-five minutes is given for the reading section of the test, it is assumed that all students will complete the first thirty questions. It is held that in this test an individual's level of comprehension

score is practically unaffected by the rate at which he chooses to work and is thus a valid measure of the power of a student to comprehend materials of increasing difficulty. The speed of comprehension score indicates the rate at which the individual has attempted to comprehend the test material and his success at comprehending it. Norms have been established and the test is generally accepted as being a valid and reliable measure of reading comprehension. The test attempts to parallel a natural reading situation and to the extent that this parallel exists the test can be considered a valid measure of the skills actually involved in reading.

Fluency Tests

From an examination of other studies of word fluency and from the results of the pilot study, a battery of ten fluency tests were devised and placed along a convergent-divergent as follows:

Divergent Tests. These tests would require a subject to produce words with a minimum of structural limitation and many different responses would be considered correct. In each test, a student is required to produce as many words as possible in a minute and a half. The following tests were thought to be measures of this dimension:

(a)	first letter	- Write words beginning with "q"
(b)	prefix	- Write words beginning with "trans"
(c)	suffix	- Write words ending in "ness"
(d)	specified letters	- Write words containing at least one "a" and one "e".

Convergent Tests. These tests would require a student to produce words with a maximum of restriction, and only particular responses would be considered correct. In each test, a student is required to produce as many responses as possible in a minute and a half. The following tests were thought to be measures of this dimension.

(a) disarranged words I - Make a word from certain given letters. (one answer possible)

(b) disarranged words II - Make two or more words from certain given letters

Mixed Convergent-Divergent Tests. It is recognized that tests of this type might conceivably load on a convergent factor, on a divergent factor, or on a general word fluency factor. These tests would require a student to produce divergent responses and then select the ones which would fit the specified structural restrictions. Again, a minute and a half is allowed for each test.

(a) specified length - Write words five letters in length

(b) first and last letters - Write words beginning with "t" and ending with "e"

(c) anagrams I - Write words using as many of the following letters as you wish "o c c u p a t i o n"

(d) anagrams II - Write words five letters in length using any five of the following letters "c i t a e n r h f b l d"

The validity and reliability of these tests as measures of word fluency were investigated and established by the pilot study.

Intelligence Test

The I.P.A.T. Culture Fair Measure of "g" Scale 2 Form A was used to assess a subject's non-verbal intelligence and thus provide the basis for partialling out the effect of this factor on level of comprehension. This test is accepted as being a measure of intelligence minimally related to verbal ability. It consists of four separate, carefully timed tests which demand the seeing of similarities, differences, and relationships between geometric figures. Each of the sub-tests are considered in themselves to be valid measures of intelligence and the use of all four tends to balance our administrative effects and chance inaccuracies. Test reliability has been evaluated both in terms of Dependability Coefficient and the Consistency Coefficient. The Dependability Coefficient has been demonstrated to be .82 and .85 on two different groups, and the Consistency Coefficient 0.70, 0.86, 0.87 and 0.92 on four different groups (29).

Pilot Study

As previously mentioned, a pilot study was undertaken to test the battery of fluency tests and to provide information as to the nature of the sample and experimental design that would be necessary to conduct the proposed study. The sample for the pilot study consisted of 213 students from grades eight, nine, ten, and eleven in a rural consolidated school. Tests used in previous research on word fluency were examined and adapted for use. The devised battery of fluency tests, the Co-operative Reading Form Z

and the I.P.A.T. Culture Fair Test of "g" Scale 2 Form A were administered to the sample using as similar procedures as possible. Appropriate statistics were then used to establish the reliability of the fluency tests and the desired time limits for their administration. Statistical procedures were also used to determine any existing male-female or grade differences in word fluency. The results indicated that the selected battery of fluency tests could be considered a reliable measure, that a ninety second time limit was feasible, that there were no significant sex differences in the scores but that there might be a slight advantage in using a female population, and finally that sufficient stability in word fluency had been established by grade eight that any grade from grade eight to eleven would be suitable for a study of word fluency. A fuller discussion of this research is to be found in the appendix. Results of this study were used in planning the experimental design for the present research.

Data Collection

Administration of Tests

The tests were administered in a group setting in the following order:

(a) Co-operative Reading Test Form Z

(b) Fluency tests

(c) I.P.A.T. Culture Fair test of "g" Scale 2 Form A

Only two groups were used and thus differences in administrative conditions were kept to a minimum. The groups were matched for age, sex, and grade

and were tested within a week of each other. In each case, the tests were administered by the author with the assistance of the teachers from the respective schools.

The Co-operative Reading Test Form Z was given using standard procedure. Fifteen minutes were given for the vocabulary section and then twenty-five minutes for the reading section making a total of forty minutes. However, if a student was finished the vocabulary section before the time was up he was allowed to proceed with the reading section.

In the administration of the fluency tests, students were asked to read the instructions at the top of each sheet, work for ninety seconds and then rest for thirty seconds. These tests were carefully times and the total testing time was nineteen and a half minutes. As each of these tests were of equal time and self instructing, they were administered in random order to minimize any pattern or inhibitory or practice effect.

The I.P.A.T. Culture Fair test of "g" was administered in the standard way. Four short timed tests were given, making a testing time of twelve and a half minutes.

A five minute rest period was given after each of the above sets of tests and extra time was needed for giving the respective instructions. Thus, a total testing time of approximately an hour and three quarters was used.

Scoring of Tests

This testing procedure provided the following scores for each of the 250 subjects:

(a) a level of reading comprehension score

(b) a speed of reading comprehension score

(c) scores on ten tests of word fluency

(d) a non-verbal intelligence score

These tests were scored by the author and checked for accuracy. Standards for marking were established before any scoring was done. The Co-operative Reading Test and the I.P.A.T. Culture Fair test of "g" were scored by the standard procedure. In the fluency tests, each word supplied was assigned one mark, the total score for each test being the total number of correct responses. A word was considered acceptable if it was included in the Oxford dictionary and correctly spelled. The insistance on correct spelling may have affected the results slightly, but accuracy in the association processes of reading is sufficiently important that this procedure would seem to be justified.

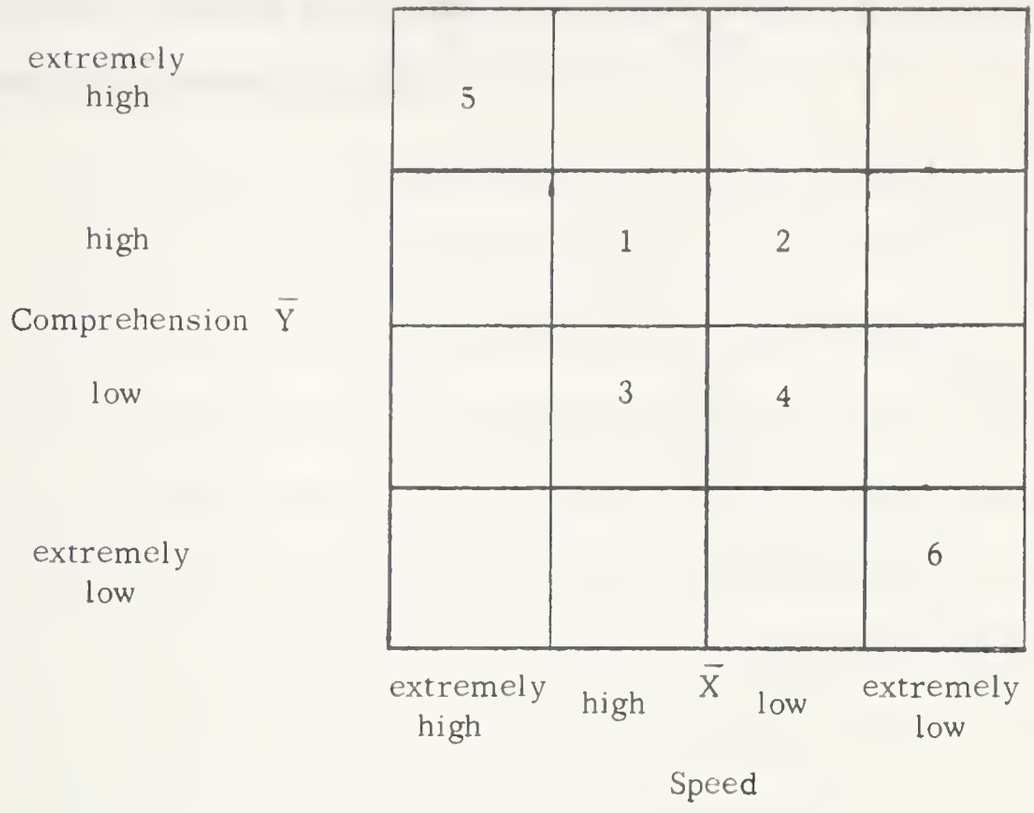
Treatment of Data

Factor analysis was applied to the ten fluency tests to determine the validity of the hypothesized convergent-divergent dimension. This statistical tool was used because it allows one to determine the number of significant factors that exist in any set of tests and to identify the tests which contribute most to the respective factors. Thus, the results of this analysis were used to construct a battery of tests of convergent word fluency and one of divergent word fluency.

Partial correlation was then used to determine the relationship between the fluency factors and speed of comprehension with the effect of level of comprehension removed. The removal of the level of comprehension factor is particularily important because the scoring procedure in the Co-operative Reading Test weights the speed factor with a factor of depth and accuracy of comprehension. Again, partial correlation was used to determine the relationship between the word fluency factors and level of comprehension with the effect of intelligence removed. Intelligence was partialled out as it is obviously an important factor in comprehension and one that varies a great deal from individual to individual. Not partialling it out might give a spurious correlation between fluency and level of comprehension.

The technique of analysis of variance was then used to provide a more rigorous analysis of the hypothesized relationship between the reading comprehension and the word fluency factors. Speed and level of comprehension were used as the classification variables and fluency as the criterion variable. As there is a fairly high correlation between speed and level of comprehension, it was believed that the reading scores would distribute themselves according to the numbered boxes of the following figure.

Figure 5 -- Estimated Distribution of Reading Scores



It was decided to use a two way analysis of variance as it reveals more information about the interaction of the various factors. The above figure reveals that the two dimensional classification is most appropriate as the scores approach the mean. In the light of this, only scores falling in blocks 1, 2, 3, and 4 were used. Extreme scores represented by blocks 5 and 6 were eliminated by not using any scores falling beyond one standard deviation from either mean. Analyses of variance using first speed of comprehension and then level of comprehension as the criterion measure were used to determine whether the scores were in fact validly divided into a two way classification matrix. Separate analyses were then used to determine differences or interaction effects among the groups on divergent and convergent word fluency.

It was expected that the above experimental procedure would yield information regarding any existing relationships between word fluency and the reading comprehension factors.

CHAPTER IV

FINDINGS OF THE STUDY

The statistical analysis of the data was designed to determine the nature of any existing relationships among the scores on the reading test, the intelligence test, and the word fluency tests. These hypothesized relationships were investigated through the techniques of factor analysis, partial correlation, and analysis of variance. Factor analysis was used to determine whether the word fluency tests were measuring one or more than one factor. If two or more factors emerged it was expected that it would be possible to place them along a convergent-divergent dimension. Since factor analysis also indicates the extent to which each test measures each factor, this information could be used to determine which tests were the most important measures of each factor. Thus, it would be possible to obtain a battery of tests measuring convergent word fluency and one measuring divergent word fluency. Partial correlation was then used as a means of showing the relationship between the fluency scores thus obtained, and the reading comprehension scores. Although this technique provided a general measure of the degree of relationship, a more rigorous and detailed examination was necessary before valid generalizations could be made. The technique of analysis of variance was used to provide this necessary rigor and detail.

Specific Factors Involved in Word Fluency

Table I shows the means and standard deviations for the word fluency tests.

TABLE I

MEANS AND STANDARD DEVIATIONS OF FLUENCY TESTS

Test	Mean	Standard Deviation
1. Specified Length	10.30	4.36
2. Specified Letters	10.39	4.67
3. Beginning Letter	8.81	3.06
4. Anagram I	8.65	4.44
5. Suffix	6.62	2.75
6. Anagram II	1.77	2.08
7. Disarranged Words I	3.24	1.62
8. Prefix	6.72	2.11
9. Disarranged Words II	4.98	2.30
10. Beginning and Ending Letter	5.80	2.67

N = 250

An examination of these results show definite differences among the tests. Since individuals and administrative conditions were held relatively constant, this variation in test scores would indicate that the tests were measuring more than one variable. To determine the number of different variables measured by the word fluency tests, factor analysis was used. The results are presented in Table 2 (page 38). Arbitrarily taking .5 as a significant factor loading, three factors clearly emerge. The first is interpreted as a general fluency factor, the tests involved being neither clearly convergent nor clearly divergent, but containing a mixture of both. Specified length, anagrams I, anagram II, and beginning and ending letters all load significantly on this factor. These tests require a flow of associative responses, but each response must be produced with definite restrictions clearly in mind. Specified length requires one to produce only those words that are five letters in length; anagrams I requires one to produce words five letters in length using only certain specified letters; and beginning and ending letters requires one to produce words that begin with "t" and end with "e". The fact that many responses are acceptable indicates a divergent aspect to these tests but the fact that each response must be measured and judged by fairly severe restrictions demonstrates a convergent aspect. Thus, these tests would be indicative of both convergent and divergent word fluency.

TABLE 2

FACTOR ANALYSIS ON THE 10 FLUENCY TESTS

Unrotated Matrix Communalities		Factor I	Factor II	Factor III
1.	.481	.581	.368	.089
2.	.563	.612	.133	.414
3.	.534	.659	.255	.184
4.	.371	.453	.367	.175
5.	.385	.338	.519	.027
6.	.491	.472	.508	.106
7.	.563	.522	.005	.540
8.	.529	.506	.327	.408
9.	.703	.475	.360	.590
10.	.418	.569	.244	.187
	5.038	2.765	1.176	1.097
Equamax Rotation Communalities		Factor I	Factor II	Factor III
1.	.481	.635x	.100	.262
2.	.563	.321	.678x	.007
3.	.534	.229	.651x	.239
4.	.371	.585x	.167	.020
5.	.385	.193	.517x	.283
6.	.491	.698	.060	.009
7.	.563	.263	.063	.703
8.	.529	.104	.720x	.002
9.	.703	.056	.173	.818x
10.	.418	.519x	.109	.369
	5.038	1.779	1.754	1.506

Transformation Matrix

.616	.615	.492
.779	.567	.267
.115	.548	.829

.5 was taken as a significant factor loading. "x" indicates such a factor loading.

Identification of Factors

Factor I - This is considered to be a general fluency factor, placed at a central location on the convergent-divergent dimension. Tests 1, 4, 6, and 10 all load significantly on this factor, that is specified length, anagram I, anagram II, and beginning and ending letters.

Factor II - This is considered a divergent fluency factor. Tests 2, 3, 5, and 8 all load significantly on this factor, that is, specified letters, beginning letter, suffix, and prefix.

Factor III - This is considered a convergent fluency factor. Tests 7 and 9 load significantly on this factor; that is, disarranged words I and disarranged words II.

The second factor appears to be divergent word fluency measured significantly by specified letters, beginning letter, suffix and prefix. These tests require a flow of associative responses with a minimum of restriction on the nature of the response. Specified letters requires a person to write words containing at least one "a" and one "e"; beginning letter requires one to write words beginning with "q"; suffix requires one to write words ending in "ness"; and prefix requires one to write words beginning with "trans". In each of these cases, the restrictions are minimal and any one of a large number of responses would be considered acceptable. Since the divergent aspect of the task is at a maximum in these tests and the convergent at a minimum, it is logical to suggest that these tests measure divergent word fluency.

The third factor would appear to be one of convergent word fluency measured by two types of disarranged words. In each case, the task requires a minimum of associative response and necessitates a synthesis of the given elements. Disarranged words I requires a person to rearrange given letters to make a word. Disarranged words II differs in that it requires a person to make two or more words out of each set of given letters. Since there is a maximum of restriction of response in each of these tasks, it would seem reasonable to suggest that these tests are measures of convergent word fluency.

This analysis clearly confirms the existence of three distinct factors in the battery of fluency tests. These factors are: general word fluency measured by beginning and ending letters, specified length, anagrams I and anagrams II; divergent word fluency measured by specified letters, suffix and prefix; and finally convergent word fluency measured by two types of disarranged words. The emergence of these three factors as well as the patterning of the factor loadings would appear to confirm the validity of hypothesizing a convergent-divergent dimension to word fluency.

To test the remaining hypotheses of the study, it was necessary to obtain a single divergent word fluency score and a single convergent word fluency score. The tests provide a series of measures of each of these factors which must be combined into a single score. The technique of factor analysis treats each test as being on an equal interval scale; thus scores are directly comparable. Since the three factors emerge on this basis, there is justification for assuming that the respective scores on the tests are additive. On this basis, an individual's general fluency score would be the sum of his scores on beginning and ending letters, specified length, anagrams I, and anagrams II; his divergent word fluency score would be the sum of his scores on specified letters, suffix, and prefix; and his convergent word fluency would be the sum of his scores on the two tests of disarranged words. Fluency scores thus obtained were used to test the remaining hypotheses of the study.

Correlation Between Word Fluency, Intelligence and Comprehension

A correlating matrix was obtained showing the intercorrelations among the word fluency factors, intelligence and the reading comprehension factors. These results are shown in Table 3 (page 42). All the correlations between word fluency and the reading comprehension factors are rather low, but this is to be expected. Since reading involves a perception of structure, one would expect a correlation between reading and the ability to produce words according to structural limitations (word fluency). But, since reading involves much more than the perception of structure, one would expect the correlation to be minimal. In fact, it is logical to suggest that word fluency correlates with reading only to the extent that perception and manipulation of word structure are important to the understanding of any written discourse.

Because word fluency is related to the speed of associative response, it is logical to expect that word fluency would show a greater relationship to speed of comprehension than to level of comprehension. The correlation between divergent word fluency and speed of comprehension is .36 while the correlation between divergent word fluency and level of comprehension is .20. Similarly, the correlation between convergent word fluency and speed of comprehension is .29 while the correlation between convergent word fluency and level of comprehension is .22. Thus, there appears to be a greater relationship between word fluency and speed of comprehension than between word fluency and level of comprehension. However, an individual's

TABLE 3

CORRELATION MATRIX

	1	2	3	4	5
1. Intelligence	1.00	.457	.457	.146	.185
2. Reading-Level of Comprehension		1.00	.612	.199	.215
3. Reading-Speed of Comprehension			1.00	.356	.285
4. Divergent Word Fluency				1.00	.293
5. Convergent Word Fluency					1.00

N = 250

speed of comprehension score on the Co-operative Reading Test is partially determined by his level of comprehension. Because of this interaction, the relationship between speed of comprehension and word fluency might be further clarified by statistically calculating the effect of the level of comprehension and removing it. Thus, partial correlation was used. The results are presented in Table 4 and Table 5 (page 44). The results demonstrate that the removal of the factor of level of comprehension reduces the correlation only slightly. The correlation between divergent word fluency and speed changes from .36 to 30 while the correlation between convergent word fluency and speed changes from .29 to .20. This would indicate that the level of comprehension is only a minimal factor in the relationship between word fluency and speed of comprehension.

As divergent word fluency is more concerned with the speed of associative response than is convergent word fluency, it is logical to suggest that divergent word fluency is more closely related to speed of comprehension than is convergent word fluency. The results do give some confirmation of this expectation. The correlation between divergent word fluency and speed of comprehension is .36 while the correlation between convergent word fluency and speed of comprehension is .29. If the effect of level of comprehension is partialled out the ratio becomes .30 to .20.

Thus the results of the present study indicate that both word fluency factors relate more closely to speed of comprehension and that there is a higher correlation between divergent word fluency and speed of comprehension

TABLE 4

PARTIAL CORRELATION OF DIVERGENT WORD FLUENCY AND SPEED OF COMPREHENSION WITH THE EFFECT OF LEVEL OF COMPREHENSION REMOVED

Correlations	
Divergent Word Fluency and Speed	.356
Divergent Word Fluency and Level	.199
Speed and Level	.612
Partial Correlation of Divergent Word Fluency and Speed	.302

N = 250

TABLE 5

PARTIAL CORRELATION OF CONVERGENT WORD FLUENCY AND SPEED OF COMPREHENSION WITH THE EFFECT OF LEVEL OF COMPREHENSION REMOVED

Correlations	
Convergent Word Fluency and Speed	.285
Convergent Word Fluency and Level	.215
Speed and Level	.612
Partial Correlation of Convergent Word Fluency and Speed	.204

N = 250

than between convergent word fluency and speed of comprehension.

An examination of the correlations between word fluency and level of comprehension reveals minimal relationship between the two factors. The correlation between convergent word fluency and level of comprehension is .22 while the correlation between divergent word fluency and level of comprehension is .20. Since convergent word fluency is more concerned with the accuracy of synthesis than is divergent word fluency one might expect convergent word fluency to relate more closely to level of comprehension than would divergent word fluency. This expectation is hardly confirmed by the above results. Since level of comprehension clearly involves a factor of intelligence the relationship between word fluency and level of comprehension might be clarified by estimating and removing the effect of this factor. The resulting correlations between the word fluency factors and level of comprehension with intelligence is partialled out are shown in Table 6 and Table 7 (page 46).

These results show that level of comprehension is relatively uncorrelated with either divergent word fluency ($r = .16$) or convergent word fluency ($r = .16$) when the effect of intelligence is removed. Again, there is no definite indication that convergent word fluency relates more closely to level of comprehension than does divergent word fluency. This would seem to indicate that neither divergent nor convergent word fluency is a relevant factor in level of comprehension.

These results demonstrate that word fluency is more clearly related

TABLE 6

PARTIAL CORRELATION OF DIVERGENT WORD FLUENCY AND LEVEL OF COMPREHENSION WITH THE EFFECT OF INTELLIGENCE REMOVED

Correlations	
Divergent Word Fluency and Level	.199
Divergent Word Fluency and Intelligence	.146
Intelligence and Level	.457
Partial Correlation of Divergent Word Fluency and Level	.156

N = 250

TABLE 7

PARTIAL CORRELATION OF CONVERGENT WORD FLUENCY AND LEVEL OF COMPREHENSION WITH THE EFFECT OF INTELLIGENCE REMOVED

Correlations	
Convergent Word Fluency and Level	.215
Convergent Word Fluency and Intelligence	.185
Intelligence and Level	.459
Partial Correlation of Convergent Word Fluency and Level	.162

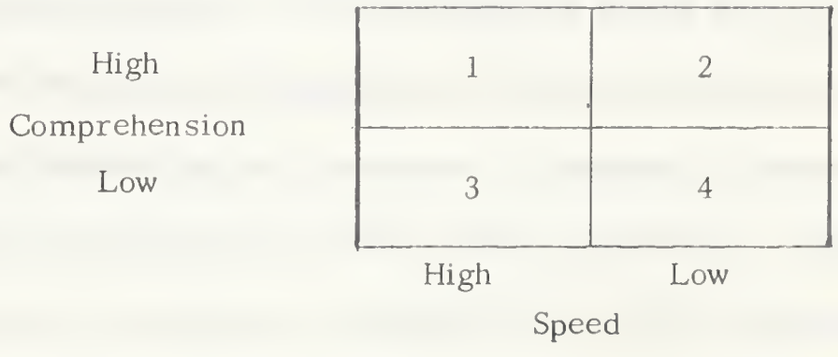
N = 250

to speed than to level of comprehension and that divergent word fluency shows a higher correlation with speed than does convergent word fluency. These correlations do give a general measure of the degree of relationship, but a more rigorous statistical analysis is demanded before one can conclude that seeming differences are significant. For this purpose analysis of variance was used.

Analysis of the Nature of the Relationship Between the Word Fluency and Reading Comprehension Factors

As suggested above, an analysis of variance technique was used to give more detailed information about the hypothesized relationship between word fluency and reading. It was assumed that reading scores were best understood as having two dimensions as follows:

Figure 6 -- Two Dimensional Distribution of Reading Scores



It would seem logical to suggest that although a very careful reader might be extremely high on comprehension and low on speed, it is more likely that the student who is extremely high on level of comprehension is also extremely high on speed of comprehension. Certainly, the student who

is extremely low on level of comprehension would also be low on speed of comprehension. These suggestions become even more valid when one considers that in the Co-operative Reading Test accuracy of comprehension is measured as part of speed of comprehension. If the above conclusions are valid, the extreme scores on both level and speed of comprehension would be found in groups 1 and 4. Thus neither groups 1 and 3 nor groups 2 and 4 could be equated on speed. The same situation would occur with level of comprehension with neither groups 1 and 3 nor 2 and 4 being able to be equated. Since the analysis of variance technique demands such equality of groups the inclusion of the extremes would be likely to obscure rather than clarify any existing relationship.

In the light of these conclusions the reading scores of the subjects were examined and all scores more than one standard deviation above or below the mean were eliminated. The remaining 165 scores were placed according to the two dimensional model above with the mean being used as a division point between high and low scores. An analysis of variance technique was used to determine the validity of this classification. Table 8 (page 49) shows the results of the analysis of variance using level of comprehension as the criterion measure. Here the classification of level shows an F value of 101. ($P < .01$ requires an F value of 6.81). This indicates that significant differences have been established between the groups on level of comprehension. The fact that there is no significant interaction ($F = .029$) and no significant difference on the speed dimension ($F = 2.96$, $P < .05$ requires an F

TABLE 8

ANALYSIS OF VARIANCE ON LEVEL OF COMPRHENSION

Source	SS	DF	MS	F
Level of Comprehension	143.718	1	143.718	101.5
Speed of Comprehension	4.052	1	4.052	2.86
Interaction	.034	1	.034	.029
Within	219.483	155	1.411	

N = 165

$P < .01$ requires an F value of 6.81

$P < .05$ requires an F value of 3.91

value of 3.91) demonstrates that group 1 and 2 are equated as to level of comprehension as are 2 and 4. Thus, groups 1 and 2 are significantly different from groups 3 and 4 when level of comprehension is taken as the criterion measure but there are no significant differences along the other dimension. These results validate the classification of groups in regards to level of comprehension.

Table 9 (page 51) shows an analysis of variance using speed of comprehension as the criterion measure. Here the classification of speed shows an F value of 278. ($P < .01$ requires an F value of 6.81). Clearly, significant differences between the groups on speed of comprehension have been established. As there is no significant interaction ($F = 1.63$) and no significant difference between the groups on level of comprehension ($F = .083$) groups 1 and 3 and groups 2 and 4 can be considered equated as to speed of comprehension. However, as groups 1 and 3 are significantly different from groups 2 and 4 the classification of the groups in regards to speed of comprehension can be considered valid.

The results from these analyses would confirm that the groups have indeed been divided into the two dimensional classification of speed and level of comprehension.

Analyses of variance were then made using the word fluency scores as criterion measures. However, any variable must be normally distributed before it can be used as a criterion measure in analysis of variance. To determine whether the convergent and the divergent word fluency scores were

TABLE 9

ANALYSIS OF VARIANCE ON SPEED OF COMPREHENSION

Source	SS	DF	MS	F
Level of Comprehension	1.429	1	1.429	.083
Speed of Comprehension	4769.961	1	4769.961	278.114
Interaction	27.982	1	27.982	1.63
Within	2658.230	155	17.150	

N = 165

$P < .01$ requires an F value of 6.81

$P < .05$ requires an F value of 3.91

normally distributed chi-square was used. For convergent word fluency chi-square equals 2.96 and for divergent word fluency chi-square equals 1.46. (dF = 8, $P < .05$ requires a F value of 2.73). As chi-square is small in both cases, normal distributions can be assumed and the fluency scores can be used as criterion measures.

Table 10 (page 53) shows an analysis of variance using divergent word fluency as the criterion measure. The results show no significant interaction (F = 2.07, $P < .05$ requires an F value of 3.91) and no significant relationship between level of comprehension and divergent word fluency (F = .005). However, there is a very clear relationship between divergent word fluency and speed of comprehension (F = 12.39, $P < .01$ requires an F value of 6.81).

Table 11 (page 53) shows an analysis of variance using convergent word fluency as the criterion measure. This analysis indicates that there is no significant interaction (F = 1.10, $P < .05$ requires an F value of 3.91) and no significant relationship between level and convergent word fluency (F = .04, $P < .05$ requires an F value of 3.91). There is, however, a significant relationship between speed and convergent word fluency (F = 4.52, $P < .05$ requires an F value of 3.91).

The above analyses indicate that there is a significant relationship between speed of comprehension and both types of word fluency. However, the relationship between convergent word fluency and speed of comprehension

TABLE 10

ANALYSIS OF VARIANCE ON DIVERGENT WORD FLUENCY

Source	SS	DF	MS	F
Level of Comprehension	3.171	1	3.171	.005
Speed of Comprehension	871.063	1	871.063	12.39
Interaction	145.671	1	145.671	2.07
Within	10898.98	155	10898.98	

N = 165

($P < .01$ requires an F value of 6.81)

($P < .05$ requires an F value of 3.91)

TABLE 11

ANALYSIS OF VARIANCE ON CONVERGENT WORD FLUENCY

Source	SS	DF	MS	F
Level of Comprehension	.4471	1	.4471	.044
Speed of Comprehension	45.568	1	45.568	4.52
Interaction	11.091	1	11.091	1.10
Within	10.082	155	10.08	

N = 165

($P < .01$ requires an F value of 6.81)

($P < .05$ requires an F value of 3.91)

is significant only at the five per cent level of confidence while the relationship between divergent word fluency and speed of comprehension is significant at the one per cent level of confidence. This may be indicative of a clearer relationship between convergent word fluency and speed. These conclusions can only be made for the central group of readers and do not necessarily indicate the relationship between the fluency and reading factors for the extremely good or the extremely poor reader.

These results confirm the existence of a convergent-divergent dimension to word fluency and indicate that there is a close relationship between these fluency factors and speed of comprehension. Further, speed of comprehension is more closely related to divergent word fluency than to convergent word fluency. There is little evidence to support the hypothesis of a relationship between word fluency and level of comprehension.

The above findings would indicate that the ability to produce words according to structural limitations would relate to speed of comprehension but not level of comprehension. Further, the fewer the restrictions imposed by the structure the greater the correlation. This implies that reading speed involves facility in divergent production of word associations.

CHAPTER V

SUMMARY, CONCLUSIONS AND IMPLICATIONS

The present study was designed to investigate the relationship between word fluency and the reading comprehension factors.

It was suggested that word fluency is a mental ability dealing with the production of words according to structural limits and has a convergent-divergent dimension. Further, it was held that a perception of the ideas in reading demands a perception of their arrangement. Again comprehension demands a perception of the words, the production of associations, the selection of the relevant ones, and the synthesis of these to produce meaning. Because of the similarity between the processes involved in word fluency and those involved in reading comprehension, it was hypothesized that both word fluency factors would correlate with reading comprehension. However, it was expected that divergent word fluency would relate most closely to speed of comprehension and convergent word fluency to level of comprehension.

To investigate the nature of word fluency and its relationship to reading, fluency tests specifically designed for this study, the Co-operative Reading Test, and the I.P.A.T. Culture Fair Test of "g" were used. These tests were administered to a carefully selected sample of grade ten females and the resulting scores analyzed with the appropriate statistics.

The results confirmed most of the hypotheses, giving clear evidence of a convergent-divergent dimension to word fluency and indicating a significant

relationship between speed of comprehension and both word fluency factors. However, the relationship between the word fluency factors and level of comprehension was not established.

Discussion of Results

Hypothesis I - There is a convergent and a divergent factor in word fluency.

The above hypothesis was tested by the technique of factor analysis. It was expected that this technique would determine whether the word fluency tests were measuring one or more than one factor. The results indicated that three significant factors were present with each test tending to load significantly on one of the factors, but not on the others. An examination of the factors indicated that there was a difference in the amount of structural limitation imposed by the tests which measured each factor. Thus, the three factors were considered to separate on the degree of structural limitation imposed by the tests. On the one hand, maximal structural limitation would seem to emphasize the process of synthesis and minimize that of free association. On the other hand, minimal structural limitation would seem to emphasize the process of free association and minimize that of synthesis. Thus, it was concluded that the factors separated along a continium of free association and synthesis. It is logical to suggest that greater structural limitation is related to convergence and lesser structural limitation to divergence. It was thus concluded that the tests measured a

convergent word fluency factor, a divergent word fluency factor, and a general word fluency factor that had both convergent and divergent aspects.

The remaining hypotheses concern the relationship between word fluency and reading comprehension. The relationship obviously becomes more complex because of the separation of word fluency into convergent and divergent factors.

Hypothesis II - There is a significant relationship between the scores of grade ten female students on tests of divergent word fluency and on tests of speed of comprehension.

Partial correlation was used to make an initial test of this hypothesis. Results indicated that there was a definite relationship between divergent word fluency and speed of comprehension when the effect of level of comprehension was removed. An analysis of variance using only the central group of readers confirmed the suggestion that slower readers scored significantly lower on tests of divergent word fluency than did faster readers. The fact that these differences were significant at the one per cent level demonstrates that there is a definite relationship between an individual's ability to produce words with minimal restriction on structure and his speed of reading.

Hypothesis III - There is a significant relationship between the scores of grade ten female students on tests of convergent word fluency and tests of speed of comprehension.

Partial correlation was used to make an initial test of this hypothesis. With the effect of level of comprehension removed there was a significant correlation between tests of convergent word fluency and tests of speed of comprehension. An analysis of variance using only the central group of

readers showed that the slower readers scored significantly lower on tests of convergent word fluency than did faster readers. However, these differences were significant only at the five per cent level. Nevertheless, these results do demonstrate that there is a definite relationship between an individual's speed of reading and his ability to produce words when much structural limitation is imposed.

Hypothesis IV - There is no significant relationship between the scores of grade ten female students on tests of divergent word fluency and tests of level of comprehension.

Partial correlation was used as an initial test of this hypothesis. With the effect of intelligence removed there are only a minimal correlation between the scores on tests of divergent word fluency and tests of level of comprehension. An analysis of variance on the central group of readers failed to reveal any significant differences between the scores of high and low comprehenders on tests of divergent word fluency. The scores of students who comprehended at a lower level were not significantly different from those who comprehended at a higher level. These results indicate that scores on tests of divergent word fluency are not related to scores on tests of level of comprehension. Thus, the production of words according to minimal structural limitation does not appear to be related to level of comprehension.

Hypothesis V - There is a significant relationship between the scores of grade ten female students on tests of convergent word fluency and on tests of level of comprehension.

Partial correlation was used as an initial test of this hypothesis. With the effect of intelligence removed there was little correlation between the

scores on tests of convergent word fluency and the scores on tests of level or comprehension. An analysis of variance on the central group of readers showed that on the convergent word fluency tests the scores of students who comprehended at a lower level were not significantly different from the scores of students who comprehended at a higher level. These results indicate that there is no significant relationship between the ability to produce words according to much structural limitation and the level of comprehension.

Conclusions

The above results indicate that word fluency is closely related to speed but not to level of reading comprehension. The greatest relationship is between divergent word fluency and speed of reading comprehension, this being significant at the one per cent level. This suggests that perception and manipulation of word structure is relevant to speed of comprehension. Further, the less severe the structural limitations the greater the relationship becomes. The results also suggest that perception and manipulation of word structure is not of particular importance to level of comprehension. This latter is contrary to the expectation that there might be a relationship between convergent word fluency and level of comprehension

Limitations

The previous conclusions can only be drawn for a very limited group. Since only grade ten females were used and because other research has suggested that both age and sex are related to verbal abilities, these conclusions must not be generalized beyond the limits of a grade ten female population. Further, the present study investigated only the written dimension of word fluency and the results cannot be applied to oral word fluency. Personality is known to be related to word fluency, but since this variable was randomized in the present study, no conclusions can be drawn as to the specific interactions of personality and the dimensions of word fluency studied in this research. Lastly, the results presented here are limited to the average reader. In the more rigorous analysis, only the middle portion of readers were used. Thus, there may be peculiar relationships between the reading comprehension and word fluency factors that have not been revealed by this study.

Implications

The present research has demonstrated that word fluency is related to speed of comprehension and has a convergent-divergent dimension. This would suggest that a speed of flexibility in manipulating word structure is the factor which most closely relates to speed of comprehension. The existence of this relationship raises the question of the effect that knowledge of

vocabulary has on speed of comprehension. Does the student who has a wide fexible store of words have a higher reading speed?

Word fluency would appear to involve emphasis on speed and on structure and be related to speed of comprehension. This would suggest that speed in reading is best attained through the development of fluency in words and in structure, but that this alone does very little in the development of depth of comprehension.

In this study, word fluency was considered to be one part of a complex factor of verbal fluency. Thus, verbal fluency was understood to be a composite of four specific factors: that is word fluency, associational fluency, ideational fluency, and expressional fluency. Since word fluency has a convergent-divergent dimension and relates to reading comprehension, the other verbal fluency factors may also have a convergent-divergent dimension and relate to reading comprehension. Indeed, one might expect that facility with ideas would be more closely related to reading than would facility with words. Thus, one might predict an even closer relationship between ideational fluency and reading comprehension than the one demonstrated between word fluency and reading comprehension.

If structure is more important to speed, are concepts also related to speed or are they more closely related to level of comprehension? If the latter is true there may be a very clear relationship between convergent ideational fluency and level of comprehension.

The above suggests that there is much research that needs to be done to determine the relationship of the other fluency factors to reading

and that such research is likely to produce important insights into the nature of reading comprehension.

Suggestions for Further Research

Similar studies could investigate the relationship of the other fluency factors to reading comprehension and determine the validity of the suggested convergent-divergent dimension for these factors.

I. Since there would appear to be a relationship between the ability to produce words and speed of comprehension, studies could investigate the relationship between these factors and knowledge of vocabulary.

II. Further research is needed to determine whether the conclusions of this study are valid for a wider population. Thus, the present study could be duplicated using a male population or using age and grade as another dimension.

III. Thus, the present research indicates that there is a convergent-divergent dimension to word fluency and that both word fluency factors have a significant relationship to speed of comprehension. It also suggests that further research into the relationship between the fluency factors and reading comprehension may yield important insights into the nature of the reading act.

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APPENDICES

APPENDIX A

PILOT STUDY

Purpose

A pilot study was conducted to select and devise tests which would be valid and reliable measures of word fluency and to give an indication as to the nature of the sample that would be necessary to conduct the proposed study.

Sample

In this study 213 students from grades eight, nine, ten and eleven of a rural consolidated school were used. Each classroom was tested as a separate group and under as similar administrative conditions as possible.

Selection of Fluency Tests

The studies of word fluency were examined to determine the nature of the tests which were considered to measure word fluency. From these tests certain ones were adopted and others were modified. Specifically, in previous research the following tests were found to load highly on a word fluency factor.

Suffixes: write as many words as possible that end in "tion" (3, 5), "en" (1), "able" (6)

First and last letters: write as many words as possible that begin with "t" and end with "e" (3, 5)

First letters: write as many words as possible that begin with "s" (5), "m" (4, 2)

Specified length: write as many words as possible that contain the letters "r" and "m" (5), "a" and "e" (4)

Anagrams: write as many words as possible using the letters in the word "abbreviation" (5), "perverseness" (6), "occupation" (1, 2)

Disarranged words: make a word out of each of the following combinations of letters:

(a) meaning given (1, 6, 4, 2)

(b) no indication of meaning (1)

Since these tests have repeatedly shown high loadings on a word fluency factor, they can be accepted as valid measures of this factor. For the present study, these tests were adopted or modified as follows:

Suffixes: write words that end in "ness". This suffix was chosen to prevent spelling errors that migh occur with "tion" and "sion".

First and last letters: write as many words as possible that begin with "t" and end with "e". This test was adopted without change.

First letters: write as many words as possible that begin with "q". The letter "q" was chosen to impose some limits on the number of responses possible.

Specified letters: write as many words as possible containing the ltters "e" and "a". This test was adopted without change.

Anagrams I: write as many words as possible using the letters in the word "occupation". This test was adopted without change.

Anagrams II: write as many five letter words as possible using the following letters -- "c i t a e n r h f b l d". This is obviously a combination of anagrams and specified length.

Disarranged words I: Rearrange each of the following sets of letters to make a word --

g i w n
r p o t
w n r b o
s m o o e
c u h r h c
n t i r a
k c a h l
i f t r u
s t e h o
r t a r h e

This test follows the pattern of no meaning being indicated. In each case only one word can be made out of the specified letters.

Disarranged words II: make two or more words out of each of the following combination of letters --

d l i a
r e s v e
a s i d
a p i m
d i r u e
s r l i e v

This test is obviously an adaption of the previous test. Here more than one closure is demanded.

Prefix: write words that begin with "trans". This was an adaption of the suffix test.

This battery of fluency tests were then administered to the sample.

Administration of Tests

For grades eight, ten, and eleven the battery of fluency tests were administered in random order allowing ninety seconds for the completion of

each test and then a thirty second rest period. For grade nine, the students worked on each test for ninety seconds, drew a line under their last response, continued working for another ninety seconds and then had a thirty second rest period. After all grades had completed the fluency tests, the Co-operative Reading Test Form Z and the I.P.A.T. Culture Fair Test of "g" Scale 2 Form A were administered using the recommended standard procedures.

Treatment of Data

Reliability of Fluency Tests

To establish the reliability of the fluency tests the scores of the subjects from grades eight, ten, and eleven were randomly divided into two groups. Table 1A (page 74) shows the mean and standard deviation of these two groups for each of the fluency tests. An examination of the difference between the two means reveals that the largest discrepancy between the two means is .17 which is obviously not significant when the standard deviation is between 4.53 and 4.57. Similarly, there is no significant difference between the means of the two groups on any of the other tests. Because the two groups were established by random selection after the tests had been administered and scored, the equality of administrative conditions and samples can be assumed. Thus, any differences between the means of the test scores can be attributed to test unreliability. The results demonstrated that there were no significant differences between the scores of the two groups, and therefore the assumption of test reliability is feasible.

TABLE 1A

MEANS AND STANDARD DEVIATIONS OF FLUENCY TESTS SCORES

Test	Group 1		Group 2		
	$\bar{x}_1$	s	$\bar{x}_2$	s	$\bar{x}_1 - \bar{x}_2$
1. Specified length	8.39	4.43	8.33	4.45	.06
2. Specified letters	9.81	4.57	8.98	4.53	-.17
3. Beginning letters	7.88	2.79	7.91	2.78	-.03
4. Anagrams I	8.15	4.63	8.19	4.61	-.04
5. Suffix	6.75	2.83	6.71	2.84	.04
6. Anagrams II	1.65	2.61	1.63	2.65	.02
7. Disarranged words I	2.73	1.61	2.69	1.59	.04
8. Prefix	5.34	2.23	5.31	2.27	.03
9. Disarranged words II	3.36	2.31	3.42	2.33	-.06
10. Beginning and ending letters	4.48	2.63	4.52	2.61	-.04

Time Restrictions for Fluency Tests

To establish a preferred time limit for students to work on the fluency tests, scores of the grade nine students were taken at a ninety second and at a one hundred and eighty second interval. Table 2A (page 76) shows these results.

An examination of these results shows that the majority of the responses seem to be produced in the first ninety seconds with only a minimal increase in scores after another ninety seconds. Further, the standard deviation for each test changes little when the time is extended. This would seem to suggest that the longer time interval does not create a different pattern of scores. Thus, the use of the ninety second time interval which has obvious administrative advantages would be justified.

Male-Female Differences in Word Fluency

To establish whether there were male-female differences in scores on tests of word fluency, the means of scores on respective tests were compared. The results are presented in Table 3A (page 77).

An inspection of these results would seem to indicate a slight female superiority on all tests except Anagrams I. However, none of the differences between the means are significant. It is also of interest to note that the standard deviation on each test is slightly higher for the females than it is for the males. This would suggest that, although no definite conclusion can be drawn, there might be some advantages to using an all-female population.

TABLE 2A

MEANS AND STANDARD DEVIATIONS OF FLUENCY TESTS SCORES FOR GRADE 9

Test	Time: 90 Seconds $\bar{x}$	90 Seconds s	180 Seconds $\bar{x}$	180 Seconds s
1. Specified length	7.68	4.42	9.18	4.42
2. Specified letters	8.56	4.51	9.73	4.52
3. Beginning letters	7.53	2.78	9.97	2.81
4. Anagrams I	7.15	4.45	8.26	4.48
5. Suffix	7.85	2.81	9.14	2.83
6. Anagrams II	1.78	2.73	1.93	2.75
7. Disarranged words I	2.62	1.59	2.81	1.63
8. Prefix	5.74	2.24	6.26	2.26
9. Disarranged words II	3.47	2.37	3.72	2.36
10. Beginning and ending letters	5.64	2.66	6.95	2.69

TABLE 3A

MEANS AND STANDARD DEVIATIONS OF FLUENCY TESTS

SCORES FOR GRADES 8, 10, AND 11

Test	Male		Female		
	$\bar{x}_1$	s	$\bar{x}_2$	s	$\bar{x}_1 - \bar{x}_2$
1. Specified length	8.02	4.41	8.71	4.44	.69
2. Specified letters	8.63	4.50	9.82	4.60	.19
3. Beginning letters	7.31	2.76	8.46	2.80	.15
4. Anagrams I	8.79	4.43	7.51	4.70	-.28
5. Suffix	6.14	2.79	7.32	3.08	.18
6. Anagrams II	1.62	2.11	1.68	2.86	.75
7. Disarranged words I	2.84	1.59	3.63	1.61	.79
8. Prefix	4.89	2.09	5.83	2.35	.05
9. Disarranged words II	2.98	2.30	3.81	2.39	.83
10. Beginning and ending letters	4.81	2.57	5.11	2.79	.30

Grade Differences in Word Fluency

To determine whether there were marked differences in word fluency from grade to grade, the scores of both male and female students were compared for grades eight, ten, and eleven. Results are shown in Table 4A (page 79) and Table 5A (page 80).

These results would seem to indicate a gradual increase in word fluency from grade eight through to grade eleven for both male and female students. Yet, for no test are the scores of grade eleven students significantly different from the scores of grade eight students. In all cases, the variation from student to student is greater than any variation from grade to grade. This would indicate that by these grades a reasonable stability in word fluency abilities has been established.

Conclusions

This pilot study indicated that the selected battery of fluency tests could be considered a reliable measure, that a ninety second time limit was feasible, that there were no significant sex differences in the scores but that there might be a slight advantage in using a female population, and finally that sufficient stability in word fluency had been established by grade 8 that any grade from 8 to 11 would be suitable for a study of word fluency.

TABLE 4A

MEANS OF TEST SCORES FOR MALE STUDENTS

Test	Grade 8		Grade 10		Grade 11	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
1. Specified length	7.14	4.58	8.25	4.45	8.67	4.41
2. Specified letters	7.54	4.42	8.63	4.53	9.39	4.58
3. Beginning letters	6.37	2.79	7.88	2.98	7.50	2.78
4. Anagrams I	8.88	4.48	8.54	4.47	9.96	4.51
5. Suffix	5.86	2.96	6.29	2.81	6.21	2.71
6. Anagrams II	1.46	2.09	1.66	2.35	1.74	2.09
7. Disarranged words I	2.17	1.63	3.14	1.53	3.18	1.58
8. Prefix	4.27	2.15	4.97	2.11	5.50	2.03
9. Disarranged words II	3.79	2.38	3.64	2.32	4.36	2.27
10. Beginning and ending letters	3.89	2.69	4.92	2.61	5.58	2.51
11. Intelligence	98.89	21.60	99.61	19.56	101.51	17.86
12. Level of Comprehension	39.27	2.90	44.89	2.60	41.89	2.54
13. Speed of Comprehension	39.43	6.89	46.03	8.41	48.67	7.51

TABLE 5A

MEANS OF TEST SCORES FOR FEMALE STUDENTS

Test	Grade 8		Grade 10		Grade 11	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
1. Specified length	8.02	4.43	8.14	4.45	9.95	4.40
2. Specified letters	8.42	4.63	9.59	4.62	10.41	4.58
3. Beginning letters	7.60	2.89	8.80	2.83	9.00	2.78
4. Anagrams I	6.86	4.81	7.68	4.79	8.10	4.80
5. Suffix	6.31	3.12	7.85	3.04	7.82	2.98
6. Anagrams II	1.61	3.08	1.70	2.91	1.73	2.87
7. Disarranged words I	3.47	1.69	3.58	1.63	3.83	1.59
8. Prefix	5.00	2.43	5.55	2.39	6.91	2.34
9. Disarranged words II	3.79	2.48	3.64	2.41	3.96	2.36
10. Beginning and ending letters	4.81	2.83	4.73	2.81	5.73	2.79
11. Intelligence	98.38	18.23	96.14	18.41	98.55	17.29
12. Level of Comprehension	39.24	2.55	43.09	2.61	41.91	2.91
13. Speed of Comprehension	41.43	8.10	51.00	6.82	51.95	7.53

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APPENDIX B

INSTRUCTIONS FOR FLUENCY TESTS

This is a series of tests; each one will take one and a half minutes. In each case you are to write down as many words as you can within the given time limit. However, each test puts different restrictions on the words that you are to write. For example, one test might ask you to write words ending in "d". Appropriate choices would then be hea<u>d</u>, re<u>d</u>, and ma<u>d</u>. A second test might ask you to write words which contain a <u>y</u>. Appropriate choices would then be <u>y</u>es, ma<u>y</u> and <u>y</u>et. Only common nouns may be used; names of people and places may not be used. You are to wait for the signal GO, turn to the first page, read the instructions and proceed as quickly as possible. At the signal STOP, quit writing, then rest, and at the signal GO, turn to the next page and proceed in the same way.

Write words ending in ness .

Write words beginning with trans .

Write words using as many of the following letters as you wish.

o c c u p a t i o n

Write words of five letters using as many of the following letters as you wish.

c i t a e n r h f b l d

Make two or more words out of each of the following combinations of letters.

d l i a

r e s v e

a s i d

a p l m

d l r u e

s r l i e v

Write words containing at least one a and one e .

Write words five letters in length.

Write words beginning with the letter t and ending with e.

Write words beginning with the letter q.

Rearrange each of the following sets of letters to make a word.

g i w n

r p o t

w n r b o

s m o o e

c u h r h c

n t i r a

k c a h l

i f t r u

s t e h o

r t a r h e

APPENDIX C

COOPERATIVE ENGLISH TEST

Test C2: Reading Comprehension

Higher Level

Form Z

Test Number 337–35–1

BY

CHARLOTTE CROON DAVIS

FREDERICK B. DAVIS

COOPERATIVE TEST DIVISION
EDUCATIONAL TESTING SERVICE

Princeton, N. J. Los Angeles, Calif.

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Directions

Do not turn this page until the examiner tells you to do so. This is a 40-minute test with two parts. Indicate your answers to all questions on the separate answer sheet. *No credit will be given for anything written in the test book.* When you have decided which of the suggested answers you want to give for a question, blacken the space between the dotted lines under the matching number on the answer sheet. Use your special pencils to make a heavy, *glossy black* line which completely fills the space between the dotted lines. Be careful not to make stray marks on your answer sheet. If you wish to change an answer, erase your first line completely and mark your new choice. Give only one answer to each question; no credit will be given for multiple answers.

When the examiner tells you to begin, turn the page, read the directions carefully, and proceed at once to answer the questions. Do not spend too much time on any one item. Answer the easier questions first; then return to the harder ones if you have time. You may answer questions even when you are not perfectly sure that your answers are correct, but you should avoid *wild* guessing, since wrong answers will result in a subtraction from the number of your correct answers.

Ask all your questions before the test begins. No questions may be asked after the test has started.

Time Limits

	MINUTES
Part I: Vocabulary	15
Part II: Reading	25
Total	40

READING COMPREHENSION TEST C2

PART I

VOCABULARY

Time—15 minutes

ections: In each group below, select the numbered word or phrase that **most nearly** corresponds in meaning to the rd at the head of that group and blacken the space opposite the appropriate question number on the answer sheet ler the number of your choice. It is quite likely that you will finish this part before the time is up. In that case **on immediately to Part II** because additional time spent on Part II will probably improve your Speed of Compresion score.

perspire
1–1 struggle
1–2 sweat
1–3 happen
1–4 penetrate
1–5 submit

myth
2–1 prophecy
2–2 legend
2–3 love potion
2–4 supernatural being
2–5 religious song

gush
3–1 giggle
3–2 spout
3–3 sprinkle
3–4 hurry
3–5 cry

jovial
4–1 refreshing
4–2 scarce
4–3 thickset
4–4 wise
4–5 jolly

role
5–1 part
5–2 circle
5–3 retreat
5–4 stake
5–5 quality

obituary
6–1 long speech
6–2 funeral service
6–3 coffin
6–4 funeral chapel
6–5 death notice

pike
kind of
7–1 bird
7–2 insect
7–3 herb
7–4 fish
7–5 snake

8. mimic
8–1 sing softly
8–2 imitate
8–3 recall
8–4 make smaller
8–5 attract

9. contamination
9–1 contradiction
9–2 contempt
9–3 warning
9–4 pollution
9–5 continuation

10. monocle
10–1 sacred stone
10–2 eyeglass
10–3 emperor
10–4 handcuff
10–5 insigne

11. cougar
11–1 candy
11–2 messenger
11–3 panther
11–4 outlaw
11–5 dancer

12. amiable
12–1 agreeable
12–2 graceful
12–3 elastic
12–4 reasonable
12–5 definite

13. immaculate
13–1 enclosed
13–2 unreal
13–3 clean
13–4 saintly
13–5 submerged

14. transition
14–1 location
14–2 explanation
14–3 change
14–4 delay
14–5 prediction

15. deliberation
15–1 freedom
15–2 great exultation
15–3 escape
15–4 careful consideration
15–5 disposition

16. ebony
kind of
16–1 stone
16–2 bone
16–3 wood
16–4 glass
16–5 metal

17. feign
17–1 pretend
17–2 prefer
17–3 wear
17–4 be cautious
17–5 surrender

18. mural
pertaining to
18–1 growth
18–2 manners
18–3 the eyes
18–4 war
18–5 a wall

19. attest
19–1 certify
19–2 condemn
19–3 dislike
19–4 boast
19–5 pardon

20. bayou
20–1 hunter's knife
20–2 cry or call
20–3 marshy inlet
20–4 mountain hut
20–5 prairie dog

21. zest
21–1 applause
21–2 sincerity
21–3 talent
21–4 joke
21–5 gusto

Go on to the next page.

22. rapier
- 22–1 warrior
- 22–2 sudden attack
- 22–3 wharf
- 22–4 sword
- 22–5 rapid thrust

23. exonerate
- 23–1 worship
- 23–2 free from blame
- 23–3 entwine
- 23–4 dry up
- 23–5 lift out of

24. dissension
- 24–1 deceit
- 24–2 ignorance
- 24–3 disagreement
- 24–4 doubt
- 24–5 expansion

25. priority
- 25–1 precedence
- 25–2 size
- 25–3 sequence
- 25–4 monastery
- 25–5 authority

26. nostalgia
- 26–1 odor
- 26–2 mild insanity
- 26–3 plants
- 26–4 homesickness
- 26–5 irritation

27. veer
- 27–1 change direction
- 27–2 hesitate
- 27–3 catch sight of
- 27–4 cover with a thin layer
- 27–5 slide

28. retaliate
- 28–1 repeat
- 28–2 keep track of
- 28–3 recover
- 28–4 recount
- 28–5 strike back

29. pretentious
- 29–1 dishonest
- 29–2 earnest
- 29–3 showy
- 29–4 humble
- 29–5 quarrelsome

30. bizarre
- 30–1 odd
- 30–2 beautiful
- 30–3 bitter
- 30–4 eager
- 30–5 clever

31. succulence
- 31–1 sweetness
- 31–2 juiciness
- 31–3 assistance
- 31–4 success
- 31–5 softness

32. barrister
- 32–1 lawyer
- 32–2 staircase
- 32–3 obstacle
- 32–4 bartender
- 32–5 barbarian

33. strop
- 33–1 hang
- 33–2 mend
- 33–3 sharpen
- 33–4 enforce
- 33–5 pause

34. composite
- 34–1 revision
- 34–2 composure
- 34–3 combination
- 34–4 companion
- 34–5 position

35. orthodox
- 35–1 conventional
- 35–2 straight
- 35–3 surgical
- 35–4 right-angled
- 35–5 religious

36. blandish
- 36–1 flatter
- 36–2 disfigure
- 36–3 suspect
- 36–4 wave
- 36–5 flicker

37. stripling
- 37–1 stream
- 37–2 narrow path
- 37–3 engraving
- 37–4 lad
- 37–5 beginner

38. adversity
- 38–1 wisdom
- 38–2 similarity
- 38–3 dislike
- 38–4 stubbornness
- 38–5 misfortune

39. duress
- 39–1 period of time
- 39–2 distaste
- 39–3 courage
- 39–4 hardness
- 39–5 compulsion

40. ignominious
- 40–1 inflammable
- 40–2 elflike
- 40–3 unintelligent
- 40–4 disgraceful
- 40–5 mysterious

41. frieze
- 41–1 fringe of curls on the forehead
- 41–2 statue
- 41–3 ornamental band
- 41–4 embroidery
- 41–5 sherbet

42. mundane
- 42–1 worldly
- 42–2 obstinate
- 42–3 deafening
- 42–4 servile
- 42–5 penniless

43. succinct
- 43–1 sudden
- 43–2 concise
- 43–3 prosperous
- 43–4 literary
- 43–5 cunning

44. culpable
- 44–1 endurable
- 44–2 pliable
- 44–3 heavy
- 44–4 noticeable
- 44–5 guilty

45. redundant
- 45–1 wavy
- 45–2 hammering
- 45–3 undesirable
- 45–4 finished
- 45–5 superfluous

Go on to the next pa

frond
46–1 water basin
46–2 leaf
46–3 forehead
46–4 impostor
46–5 shady nook

lintel
47–1 shelf
47–2 small window
47–3 silver paper
47–4 pulpit
47–5 horizontal support

deleterious
48–1 injurious
48–2 hysterical
48–3 critical
48–4 slow
48–5 thinned out

remiss
49–1 returned
49–2 misplaced
49–3 hopeless
49–4 negligent
49–5 unsteady

antipodal
50–1 outmoded
50–2 slanted
50–3 melodious
50–4 opposite
50–5 four-footed

51. libidinous
51–1 slanderous
51–2 lustful
51–3 treacherous
51–4 liberal
51–5 active

52. anathema
52–1 pithy saying
52–2 patriotic song
52–3 fable
52–4 curse
52–5 disease

53. treacle
53–1 sewing machine
53–2 framework
53–3 leak
53–4 apple butter
53–5 molasses

54. lissome
54–1 lonely
54–2 young
54–3 dreamy
54–4 supple
54–5 dainty

55. fraught
55–1 distorted
55–2 frightened
55–3 laden
55–4 unhappy
55–5 concealed

56. devious
56–1 deep
56–2 devout
56–3 vicious
56–4 defective
56–5 winding

57. procreate
57–1 sketch
57–2 inhabit
57–3 imitate
57–4 beget
57–5 encourage

58. nascent
58–1 colorful
58–2 broad
58–3 unpleasant
58–4 floating
58–5 beginning

59. vendetta
59–1 saleswoman
59–2 feud
59–3 dagger
59–4 head covering
59–5 street fair

60. dross
60–1 froth
60–2 waste material
60–3 dry spell
60–4 undivided whole
60–5 swamp

Go on to the next part.

PART II

READING

Time—25 minutes

Directions: This part consists of selections taken from stories, articles, textbooks, etc. Following each passage are several multiple-choice questions concerning it. In each case you are to **read the passage carefully first** and then decide, on the basis of the passage, which one of the choices following each question **best** answers that question. If you cannot decide, you may go back to the passage. Then blacken the space on the answer sheet under the number of your choice. You are not expected to finish in the time allowed, but work as rapidly as you can without making careless mistakes.

(1) In April 1902 Belle married John Haness, a jolly
(2) Norwegian who became well liked by the neighbor-
(3) ing farmers in the few months of wedded bliss that
(4) he enjoyed. In December he was killed when, as
(5) Mrs. Haness explained, he was struck on the head
(6) by a sausage grinder that fell from a shelf. It is
(7) idle to speculate whether the shelf had been jiggled.
(8) The coroner, although later he admitted "things
(9) looked a little queer," officially found that Haness
(10) died accidentally. Belle received his $4000 life
(11) insurance.
(12) In 1906 a Mr. Bruno Moe arrived at Belle's farm.
(13) He was husky, good-looking, and a native of Nor-
(14) way. He brought $1000 with him to "pay off the
(15) mortgage" on the farm. For a week he was seen
(16) around the house every day. Then one day he
(17) wasn't there. He has never been seen since.
(18) In April 1907 Mr. Ole Bjorke, also a native
(19) Norwegian but long a resident of Minnesota,
(20) packed his suitcase and entrained for La Porte.
(21) Belle met him at the station. They had long since
(22) exchanged photographs and had no trouble recog-
(23) nizing each other. Whatever her faults, Belle
(24) never attempted to attract men by retouching
(25) pictures; the ones she sent out looked cruelly like
(26) her. Nor did she have recourse to cosmetics,
(27) beauty parlors, or stylish clothes. Bjorke brought
(28) with him $2000 in cash for "raising the mortgage."
(29) He was never seen again.
(30) Neighbors noted that Belle kept her cellar locked
(31) except at hog-butchering season, when she might
(32) be found wielding knife and cleaver with strength
(33) and skill. The cellar contained a heavy hardwood
(34) table and a large tank for scalding purposes. In
(35) the ceiling over the tub were a hook and pulley.
(36) Leather strips along the wall held a professional
(37) assortment of fine butcher's implements.
(38) In January 1908 Mr. Arne Lund arrived and
(39) was made welcome by the charming hostess of what
(40) was soon to be known the country over as Abattoir
(41) Acres. He was also born in Norway but had been
(42) raising wheat in Dakota for several years. In his
(43) wallet was $3000 in cash. One of the letters Belle
(44) had written him survives. It closed, "My Arne,
(45) I love you. Come prepared to stay forever."
(46) And he did. At least no one saw him leave.

1. Belle was
   - 1–1 homely.
   - 1–2 stupid.
   - 1–3 nervous.
   - 1–4 weak.
   - 1–5 clumsy.

2. In what respect were all of Belle's visitors alike?
   - 2–1 Appearance
   - 2–2 Experience in farming
   - 2–3 Romantic background
   - 2–4 Nationality
   - 2–5 Dishonest intentions

3. The writer implies that Belle
   - 3–1 was a good wife to Haness.
   - 3–2 may have assisted the sausage grinder off the shelf.
   - 3–3 disliked the sight of blood.
   - 3–4 fell deeply in love over and over again.
   - 3–5 was a victim of circumstances.

4. Belle was *not*
   - 4–1 insincere.
   - 4–2 cruel.
   - 4–3 determined.
   - 4–4 interested in money.
   - 4–5 vain.

5. It is clear that Ole Bjorke
   - 5–1 went back to Minnesota.
   - 5–2 had never seen Belle before.
   - 5–3 was an old friend of Belle's.
   - 5–4 had been a spendthrift.
   - 5–5 found Belle unattractive.

6. Belle apparently requested her visitors to bring with them
   - 6–1 a photograph of themselves.
   - 6–2 a life-insurance policy.
   - 6–3 a letter from her.
   - 6–4 considerable cash.
   - 6–5 bank books and other evidence of property.

Go on to the next page.

Who is described in the passage as having an attractive personality?

7–1 Belle
7–2 Haness
7–3 Moe
7–4 Bjorke
7–5 Lund

The writer describes the cellar in detail, probably because

8–1 the visitors were concealed there during their stay at the farm.
8–2 Belle spent most of her time there.
8–3 the visitors were done away with there.
8–4 it impressed the visitors with Belle's efficiency as a farm wife.
8–5 hog-butchering is an important part of a farmer's activities.

The writer implies that Belle was soon to be accused of

9–1 bigamy.
9–2 kidnaping.
9–3 murder.
9–4 bribery.
9–5 forgery.

The writer is sarcastic in the phrase

10–1 idle to speculate (line 7).
10–2 a little queer (line 9).
10–3 raising the mortgage (line 28).
10–4 professional assortment (lines 36 and 37).
10–5 charming hostess (line 39).

11. "Idle" in line 7 means most nearly

11–1 useless.
11–2 worthless.
11–3 unoccupied.
11–4 stupid.
11–5 inefficient.

12. "Found" in line 9 means most nearly

12–1 discovered.
12–2 solved.
12–3 understood.
12–4 learned.
12–5 determined.

13. The tone of the passage is

13–1 solemn.
13–2 puzzled.
13–3 annoyed.
13–4 informal.
13–5 despondent.

- - - - - - - - - - -

Go on to the next page.

The boundaries of Antarctica (the continent around the South Pole), as far as they are at present known, coincide almost exactly with the Antarctic Circle over half its extent. There is only one promontory of land, or possibly of big islands, known as Graham Land, that extends out of the Circle. This points toward South America, reaching to within 60 miles of Tierra del Fuego. There are two vast inlets that penetrate into the body of Antarctica. One, known as the Weddell Sea, lies south of the Atlantic; the other, known as the Ross Sea, lies south of New Zealand and extends to within 350 miles of the South Pole.

Antarctica is divided into four sections (by the meridians of longitude 0°, 90°W, 180°, and 90°E): the Weddell Quadrant, below South America; the Ross Quadrant, below the Pacific; the Victoria Quadrant, lying between 180° and 90° East Longitude, below Australia and the Indian Ocean; and the Enderby Quadrant, below Africa.

14. How many degrees of longitude does each section of Antarctica include?

14–1 45
14–2 60
14–3 90
14–4 180
14–5 270

15. Since the prime meridian of longitude (0°) runs through Western Africa, it is apparent that the Enderby Quadrant extends from

15–1 0° to 90° West Longitude.
15–2 90° West Longitude to 180°.
15–3 0° to 180°.
15–4 180° to 90° East Longitude.
15–5 90° East Longitude to 0°.

16. The passage implies that

16–1 Antarctica has not been completely explored.
16–2 the South Pole is largely surrounded by water.
16–3 all of Antarctica is within the Antarctic Circle.
16–4 Antarctica is the smallest of the earth's continents.
16–5 Graham Land is the best-known part of Antarctica.

17. The passage indicates that the continent extending closest to Antarctica is

17–1 Australia.
17–2 South America.
17–3 Asia.
17–4 Africa.
17–5 New Zealand.

18. One would infer from the passage that the body of water coming closest to the South Pole is the

18–1 South Atlantic.
18–2 Indian Ocean.
18–3 Weddell Sea.
18–4 Ross Sea.
18–5 Pacific Ocean.

19. Going directly south from Australia, one would reach

19–1 the Weddell Quadrant.
19–2 the Victoria Quadrant.
19–3 the Ross Quadrant.
19–4 the Enderby Quadrant.
19–5 Graham Land.

20. The quadrants mentioned have roughly the shape of

20–1 squares.
20–2 rectangles.
20–3 circles.
20–4 parallelograms.
20–5 triangles.

21. "Its" in the fourth line refers to

21–1 Antarctica (first line).
21–2 continent (first line).
21–3 Pole (second line).
21–4 Circle (third line).
21–5 half (fourth line).

– – – – – – – – – – –

Sir Lewis Morris was complaining to Oscar Wilde about the neglect of his poetry by the press. "It is a conspiracy of silence. What ought I to do, Oscar?"

"Join it," replied Wilde.

22. Wilde regarded Morris's poetry as

22–1 unjustly ignored.
22–2 dangerous.
22–3 promising.
22–4 indecent.
22–5 poor.

23. "It" in the last line refers to

23–1 neglect.
23–2 poetry.
23–3 press.
23–4 conspiracy.
23–5 silence.

24. To Morris, Wilde's reply was

24–1 pitying.
24–2 insincere.
24–3 unexpected.
24–4 encouraging.
24–5 vague.

– – – – – – – – – – –

Go on to the next page.

Why did the French have practically a monopoly of good painting in the nineteenth century? Why did the Dutch and Flemish enjoy much the same position in the late sixteenth century and all of the seventeenth, and the Italians from the fourteenth until well into the sixteenth? Note, too, how rare it is that a truly great artist appears alone—a one-man renaissance, so to speak—unaccompanied by a group. The French, in the course of their lucky century, did not get just Courbet or Renoir or Delacroix; they got them and a dozen other painters equally good. The Dutch got not only Rembrandt and Hals but Cuyp, Ruysdale, Hobbema, and Vermeer. Renaissance Venice, a town hardly larger than Bridgeport, had not just Titian and Veronese but Tintoretto, Giorgione, and the three Bellinis. It would appear that in art a nation hits the jackpot or nothing.

The passage does not in any way refer to
25–1 Dutch painters.
25–2 Flemish painters.
25–3 French painters.
25–4 English painters.
25–5 Italian painters.

The writer compares Venice with Bridgeport in order to indicate that Venice was
26–1 not a large city.
26–2 near a large city.
26–3 on the coast.
26–4 a center for artists.
26–5 populated with Italians.

Which one of the following words is *least* in keeping with the tone of the passage?
27–1 Monopoly (line 1)
27–2 Renaissance (line 8) .
27–3 Lucky (line 10)
27–4 Dozen (line 12)
27–5 Jackpot (line 18)

The *first* of the two main points made by the writer is that
28–1 good painting is likely to be done by the artists of only one country at a time.
28–2 almost the only good painting of the nineteenth century was done by French artists.
28–3 truly great painters are likely to appear in groups.
28–4 the size of a city or a country has little to do with the number of painters it has produced.
28–5 there are many questions about art that cannot be answered.

29. The *second* of the two main points made by the writer is that
29–1 good painting is likely to be done by the artists of only one country at a time.
29–2 almost the only good painting of the nineteenth century was done by French artists.
29–3 truly great painters are likely to appear in groups.
29–4 the size of a city or a country has little to do with the number of painters it has produced.
29–5 there are many questions about art that cannot be answered.

30. Of the painters named, the largest number came from
30–1 France.
30–2 Holland.
30–3 Venice.
30–4 Italy, outside of Venice.
30–5 Flanders.

* * * * * * * * *

Some thirty years ago when Atwood attempted his first nonstop flight from St. Louis to New York, he got hopelessly lost in a fog and was finally forced to land in a meadow. A crowd of villagers ran toward him. Atwood had lost his bearings completely and yelled, "Where am I?" "Why," said one of the natives, "you're in Jim Noll's cow pasture."

31. The native's reply to Atwood's question
31–1 made him feel right at home.
31–2 caused him considerable worry.
31–3 told him exactly what he wanted to know.
31–4 struck him as unbelievable.
31–5 struck him as inadequate.

32. The point of this story is that the native was
32–1 eager to help Atwood.
32–2 angry to find that Atwood had endangered Jim Noll's cows.
32–3 curious about Atwood and his plane.
32–4 unable to supply the kind of information Atwood needed.
32–5 thinking entirely in terms of his own tiny community.

– – – – – – – – – – –

Go on to the next page.

(1) One day in 1856 during his early experiments
(2) with coal tar, Perkin was oxidizing some aniline oil
(3) when he got what chemists most detest, a black
(4) tarry mass, instead of nice clean crystals. When
(5) he used some alcohol to wash this out, he was sur-
(6) prised to find that it gave a beautiful purple solu-
(7) tion. This was "mauve," the first of the aniline
(8) dyes.
(9) Perkin's next great triumph, ten years later, was
(10) in the manufacture of alizarin, the coloring matter
(11) contained in the madder root. It was an ancient
(12) dyestuff known as Turkey red. A couple of
(13) French chemists, Robiquet and Colin, extracted
(14) from madder its active principle, alizarin, in 1828,
(15) but it was not until forty years later that it was
(16) discovered that alizarin had for its base one of the
(17) coal-tar products, anthracene. Then came a neck-
(18) and-neck race for six months between Perkin and
(19) two German chemists to discover a cheap process
(20) for making alizarin from anthracene. Perkin filed
(21) his application at the patent office for the sulfuric-
(22) acid process on October 5, 1868; one day later
(23) Graebe and Liebermann filed theirs for the same
(24) process.
(25) In 1909 Friedlander analyzed Tyrian purple and
(26) found that it was the same as a dye that had been
(27) prepared five years earlier by Sachs. The coloring
(28) principle was a di-brom indigo, that is, the same
(29) as the substance extracted from the indigo plant,
(30) with the addition of two atoms of bromine. That
(31) indigo on breaking up gave off aniline was dis-
(32) covered as early as 1835 by Frische. But how to
(33) reverse the process and get indigo from aniline was
(34) still puzzling chemists fifty years later. The prob-
(35) lem was finally solved about that time by Von
(36) Baeyer, who lived until 1917.

33. "This" in line 5 refers directly to
- 33–1 coal tar (line 2).
- 33–2 aniline oil (line 2).
- 33–3 black tarry mass (lines 3 and 4).
- 33–4 crystals (line 4).
- 33–5 alcohol (line 5).

34. Perkin's first reaction on seeing the tarry mass (line 4) was probably one of
- 34–1 disappointment.
- 34–2 surprise.
- 34–3 pleasure.
- 34–4 interest.
- 34–5 disbelief.

35. The first aniline dye to be discovered was
- 35–1 Turkey red.
- 35–2 indigo.
- 35–3 Tyrian purple.
- 35–4 mauve.
- 35–5 alizarin.

36. According to the passage, who discovered that anthracene was the base for alizarin?
- 36–1 Perkin
- 36–2 Robiquet and Colin
- 36–3 Graebe and Liebermann
- 36–4 Frische
- 36–5 The passage does not say

37. The sulfuric-acid process mentioned in lines 21 and 22 was a process to
- 37–1 make alizarin from anthracene.
- 37–2 extract alizarin from madder.
- 37–3 make sulfuric acid from alizarin.
- 37–4 make sulfuric acid from anthracene.
- 37–5 make anthracene from coal tar.

38. The passage indicates that the method of getting indigo from aniline was discovered
- 38–1 as early as 1835.
- 38–2 about 1885.
- 38–3 in 1909.
- 38–4 five years before Tyrian purple was first analyzed.
- 38–5 in 1917 or a little earlier.

39. That aniline is given off when indigo is broken up was discovered by
- 39–1 Frische.
- 39–2 Friedlander.
- 39–3 Von Baeyer.
- 39–4 Sachs.
- 39–5 Liebermann.

40. Which one of the following events occurred within ten years after the extraction of alizarin from madder root by Robiquet and Colin?
- 40–1 The discovery of mauve
- 40–2 The discovery that indigo on breaking up gives off aniline
- 40–3 The race between Perkin and the German chemists
- 40–4 The analysis of Tyrian purple
- 40–5 The discovery that anthracene is the base for alizarin

41. The passage implies that a dye corresponding to Tyrian purple was first prepared by
- 41–1 Perkin.
- 41–2 Graebe.
- 41–3 Friedlander.
- 41–4 Sachs.
- 41–5 Frische.

Go on to the next pa

42. The dates and periods of time mentioned in the first two paragraphs would be consistent with one another if
- 42–1 1854 were substituted for 1856 in line 1.
- 42–2 twelve years were substituted for ten years in line 9.
- 42–3 1830 were substituted for 1828 in line 14.
- 42–4 forty-two years were substituted for forty years in line 15.
- 42–5 ten months were substituted for six months in line 18.

43. Of the following, the most appropriate title for this passage is
- 43–1 The Discovery of Certain Aniline Dyes.
- 43–2 The Many Uses of Coal Tar.
- 43–3 The Importance of Indigo.
- 43–4 Perkin and His Discoveries.
- 43–5 Cooperation Among Chemists.

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Mark Twain's habit of swearing was revolting to his wife, who tried her best to cure him of it. One day he cut himself while shaving and recited his entire vocabulary. When he finished, his wife repeated every word he had said. Mark Twain looked at her calmly and said, "You have the words, dear, but you lack the tune."

44. "Entire vocabulary" means all the
- 44–1 profanity there is.
- 44–2 profanity that Mark Twain thought suitable for his wife to hear.
- 44–3 profanity that Mark Twain knew.
- 44–4 words that Mark Twain knew.
- 44–5 words that Mark Twain could remember at the time.

45. Mark Twain's comment meant that
- 45–1 he wanted his wife to try again.
- 45–2 his wife's performance had made a deep impression on him.
- 45–3 his wife's performance lacked emphasis and conviction.
- 45–4 his wife should have sung the words.
- 45–5 his wife had no ear for music.

46. It is most likely that
- 46–1 this incident caused Mark Twain to stop swearing.
- 46–2 Mark Twain's wife never mentioned his swearing again.
- 46–3 Mark Twain's wife soon ceased to mind his swearing.
- 46–4 Mark Twain's wife kept on trying to cure him by this method.
- 46–5 Mark Twain continued to swear on occasion.

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Clive advanced against the native ruler, Surajah Daula (the English privates called him Sir Roger Dowler), with about a thousand English and twice as many natives. The enemy had 40,000 native infantry with muskets and cannon and 5000 cavalry. In the battle of Plassy, Clive scattered the native army to the winds, captured its camp with all guns and baggage, and lost twenty-two killed and fifty wounded of his English troops, against the enemy's loss of over five hundred killed. Surajah Daula escaped in disguise but was captured and killed by an official of his own government.

47. The English privates called the native ruler Sir Roger Dowler because
- 47–1 he reminded them of an English nobleman.
- 47–2 his Hindu name sounded like that to them.
- 47–3 the government had given him that title.
- 47–4 they thought it would please him.
- 47–5 they thought it would annoy him.

48. The native ruler's army outnumbered Clive's army (English and native)
- 48–1 45 to 1.
- 48–2 40 to 1.
- 48–3 40 to 3.
- 48–4 15 to 1.
- 48–5 10 to 1.

49. The outcome of the battle of Plassy was
- 49–1 an overwhelming victory for the English.
- 49–2 a victory for the English by a small margin.
- 49–3 an overwhelming victory for the natives.
- 49–4 a victory for the natives by a small margin.
- 49–5 not a definite victory for either side.

50. The passage does not say how many
- 50–1 native soldiers Clive had.
- 50–2 native soldiers in Clive's army were killed or wounded.
- 50–3 English troops were killed.
- 50–4 English troops were wounded.
- 50–5 cavalry Surajah Daula had.

51. Surajah Daula was killed by
- 51–1 an English private in disguise.
- 51–2 an English officer in disguise.
- 51–3 a native soldier in Clive's army.
- 51–4 a native soldier in his own army.
- 51–5 one of his own officials.

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Go on to the next page.

Every man who has grown out of his childish faith in the sanity of things and has developed a social consciousness has erected a structural frame for his ideas. In tracing his own development, he is bound to tell about that. If a writer is afraid to appear self-important and arrogant, he had better leave out the story of his brain altogether. But then what will remain?

I once met a well-known American who told me that he had seen Abraham Lincoln. "Yes," I said eagerly.

"He was as close to me as you are. Closer."

"Well?"

"I saw him."

"And what did you see?"

"Abraham Lincoln, of course. Surely you've heard of him."

That was really modest history, a *locus*, and beyond that—nothing. But the alternative would have been to pronounce a judgment on Abraham Lincoln.

52. The story about Lincoln is told mainly to
- 52–1 provide an interesting sidelight on him.
- 52–2 suggest that he was a real person.
- 52–3 encourage the reader to find out more about him.
- 52–4 demonstrate the American's stupidity.
- 52–5 illustrate the point the writer makes in the first paragraph.

53. When the writer of the passage talked with the well-known American, the writer apparently
- 53–1 knew nothing about Lincoln.
- 53–2 worshiped Lincoln.
- 53–3 was interested in getting a firsthand impression of Lincoln.
- 53–4 felt that Lincoln was overrated.
- 53–5 was not interested in Lincoln.

54. The answer expected to the question at the end of the first paragraph is
- 54–1 "Practically nothing."
- 54–2 "Much that is worth telling."
- 54–3 "Only the life of the brain."
- 54–4 "All that can be told objectively."
- 54–5 "All that can be told modestly."

55. The writer regards the American's account of his meeting with Lincoln as
- 55–1 exciting.
- 55–2 amusing.
- 55–3 pointless.
- 55–4 conceited.
- 55–5 insulting.

56. It is apparent that the writer is
- 56–1 an American.
- 56–2 unfriendly to Americans.
- 56–3 unfriendly to Lincoln.
- 56–4 a man who lived at the same time as Lincoln.
- 56–5 not afraid to seem self-important.

57. This passage was probably taken from
- 57–1 a novel.
- 57–2 a collection of humorous stories.
- 57–3 a short story.
- 57–4 an autobiography.
- 57–5 a biography of Lincoln.

58. The word "that" (the last word in the second sentence) refers to
- 58–1 faith (first line).
- 58–2 consciousness (second and third lines).
- 58–3 frame (third line).
- 58–4 ideas (third line).
- 58–5 development (fourth line).

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One evening when Lloyd George was addressing a meeting of hostile suffragettes, one woman in an ugly mood rose and said, "If you were my husband, I'd give you poison." Lloyd George snapped back, "My dear lady, if I were your husband, I would take poison."

59. Lloyd George in his reply probably emphasized the word
- 59–1 lady.
- 59–2 if.
- 59–3 your.
- 59–4 husband.
- 59–5 poison.

60. It is most likely that Lloyd George's reply
- 60–1 calmed the lady down.
- 60–2 enraged the lady still more.
- 60–3 won the audience over to his point of view.
- 60–4 made his own supporters sorry for him.
- 60–5 made his own supporters angry.

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Go on to the next page.

I am the victim of intermittent attacks of ambition to patch up a faulty education. My ardor seldom lasts beyond the stage of purchasing some books on the passing enthusiasm, glancing over their contents, then putting them away with the intention of someday tackling the subject in earnest. The latest spell of intellectual thirst was brought about by the remark of a friend who, sitting on my porch, suddenly exclaimed, "Why, I never realized you had pipits!"

It is definitely disturbing all at once to be told you have pipits. For an uncomfortable moment I thought she referred to some infirmity. Then when she said, "There it is, hear?" and when the only apparent sound was the squeak of a plank in the floor, I wondered if she meant termites. However, her next remark was "Hear him? He's in that bush."

"Oh, yes," I said with the complacence of the owner of a Derby winner. If she was going to show off I could too. "We have flocks of them."

"But they don't go in flocks!"

"They do here," I countered; then added lamely, "this is a sort of bird sanctuary."

"How fascinating!" she cooed. "Just what species do you get?"

I couldn't have felt more panic-stricken. "Well, robins," I said, but this didn't satisfy her; so I added, "sea gulls and hummingbirds and an occasional eagle. And now how about some tea?"

61. The writer says that one result of the conversation quoted was to make her
- 61–1 start on a course of study.
- 61–2 give up one of her hobbies.
- 61–3 establish a bird sanctuary in her garden.
- 61–4 become more truthful.
- 61–5 stop putting things off.

62. When the writer tries to learn about a new subject, she usually begins by
- 62–1 attending lectures.
- 62–2 buying books.
- 62–3 asking her friends about it.
- 62–4 observing things connected with it.
- 62–5 talking with authorities in the field.

63. The writer thought that her guest was
- 63–1 a famous authority on birds.
- 63–2 pretending to know more than she really did.
- 63–3 eager to display her knowledge.
- 63–4 eager for tea.
- 63–5 an interesting person to talk with.

64. From this passage, one would conclude that pipits must be a kind of
- 64–1 skin blemish.
- 64–2 bird.
- 64–3 insect.
- 64–4 plant.
- 64–5 food.

65. We may infer that the writer's garden has been visited by
- 65–1 sea gulls.
- 65–2 hummingbirds.
- 65–3 eagles.
- 65–4 robins.
- 65–5 all the birds she mentions.

66. The writer suggested that her visitor might like some tea because
- 66–1 she felt hungry herself.
- 66–2 she wanted to change the subject.
- 66–3 she wanted to be polite.
- 66–4 it was tea time.
- 66–5 she didn't want her to leave without having it.

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One of the chief functions of creamed dishes in restaurants is to get rid of odds and ends of food. They are a blessing if you don't overdo them and if you make a really good cream sauce. There is no substitute for butter, which is a milk product and has a natural affinity for it. Any other fat will lend a foreign flavor. You must use flour—not cornstarch. The flour and butter must be cooked together, with constant stirring, over a low fire for ten minutes. Then add boiling hot milk; cold milk is the certain cause of lumps. Cook at least five minutes more, stirring briskly with a wire whip. Cream sauce should be made fresh every day. If some is left over, it can be stored in the icebox. Let it cool thoroughly before putting it away and be sure to reheat the next day before adding to the new batch. Mix the main ingredient into the cream sauce in small amounts only, until you are sure the dish is selling well.

67. The writer warns against
- 67–1 wasting odds and ends of food.
- 67–2 having too many creamed dishes.
- 67–3 cooking the sauce too long.
- 67–4 making too little sauce at a time.
- 67–5 having the milk too hot.

68. The writer recommends
- 68–1 using no fat except butter in the sauce.
- 68–2 throwing away any leftover sauce.
- 68–3 putting the sauce in the icebox when it is lukewarm.
- 68–4 using any pure animal fat.
- 68–5 using a good grade of cornstarch.

69. The writer mentions as a cause of lumps
- 69–1 using cold milk.
- 69–2 having the fire too hot.
- 69–3 stirring too little.
- 69–4 using too much flour.
- 69–5 using cornstarch.

70. The reason why the writer advises mixing the main ingredient and the sauce in small amounts is that
- 70–1 they can be mixed more thoroughly.
- 70–2 any leftover ingredient or sauce can be used in different ways later.
- 70–3 it will save time for the cooks and waitresses when they are busiest.
- 70–4 the proportion of main ingredient to sauce can be regulated.
- 70–5 the size of the portion can be kept uniform.

71. If these directions are followed, it is certain that the sauce will
- 71–1 be entirely used up each day.
- 71–2 cost as little as possible.
- 71–3 have a delicious foreign flavor.
- 71–4 keep indefinitely.
- 71–5 take at least fifteen minutes to make.

72. To which one of the following words or phrases in the first sentence does "they" in the second sentence refer?
- 72–1 Functions
- 72–2 Dishes
- 72–3 Restaurants
- 72–4 Odds and ends
- 72–5 Food

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In a Viennese museum was exhibited the piano used by Beethoven. An American girl walked casually toward it and ran off a careless air. Turning to the attendant, she asked whether there had not been great pianists to inspect the instrument. He replied that a short time ago Paderewski had made a pilgrimage to this shrine. "Paderewski!" said the girl. "Surely he must have played something beautiful on it."

"On the contrary," responded the guard, "he did not feel worthy to touch it."

73. It is clear that
- 73–1 it was not usual for visitors to play the piano.
- 73–2 the piano had not really been used by Beethoven.
- 73–3 the girl was a trained musician.
- 73–4 Paderewski had little respect for Beethoven.
- 73–5 the girl did not know who Paderewski was.

74. The guard's attitude toward the girl was
- 74–1 encouraging.
- 74–2 humble.
- 74–3 disapproving.
- 74–4 flippant.
- 74–5 indulgent.

75. The guard's last remark probably made the girl feel
- 75–1 relieved.
- 75–2 grateful.
- 75–3 disgusted.
- 75–4 embarrassed.
- 75–5 disappointed.

76. "Air" in the third line most nearly means
- 76–1 breeze.
- 76–2 appearance.
- 76–3 manner.
- 76–4 tune.
- 76–5 attitude.

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Go on to the next page.

In most places the rich dry soil of the pampas is occupied by a coarse grass three or four feet high which grows in large tussocks and all the year round is of a deep green. There are patches where it does not grow and these are carpeted by creeping light green herbs and are gay in spring with flowers. On marshy grounds there are lilies —yellow, white, and red—and various other small flowers; but altogether the pampas have fewer species of plants than any other fertile district on the globe. On moist clayey ground flourishes the stately pampa grass, the spears of which often attain a height of eight or nine feet.

This plant covers large areas with a sea of fleecy white plumes; in late summer and autumn are seen the tints, which are the crowning beauty of the pampa grass, varying from the most delicate rose to a rich purple. At no time does it look so perfect as in the early autumn just at sunset, when the softened light imparts a mistiness to the crowding plumes and they seem to reflect the colored vapors of the afterglow.

At other hours and seasons the general aspect of the plain is monotonous and, in spite of the unobstructed view and the unfailing verdure and sunshine, somewhat depressing. The wind gives out an endless variety of sorrowful sounds, from the sharp fitful sibilations of the dry wiry grasses on the barren places to the long mysterious moans that swell and die in the tall polished rushes of the marsh. The voices of the birds are subdued and seem to be in accord with the aeolian wind tones.

77. The chief purpose of the writer is to
- 77–1 present as many facts as possible about the pampas.
- 77–2 tell an interesting story of the pampas.
- 77–3 compare the pampas with other areas.
- 77–4 describe the pampas and their general atmosphere.
- 77–5 discourage travelers from visiting the pampas.

78. The writer does *not* say that the pampas have any
- 78–1 herbs.
- 78–2 flowers.
- 78–3 marshes.
- 78–4 birds.
- 78–5 trees.

79. The chief beauty of the pampa grass is its
- 79–1 scent.
- 79–2 height.
- 79–3 color.
- 79–4 motion.
- 79–5 delicacy.

80. The writer says that the pampas
- 80–1 are not fertile.
- 80–2 are covered with a coarse brown grass.
- 80–3 have relatively few species of plants.
- 80–4 usually have a moist clayey soil.
- 80–5 have little wind.

81. The writer implies that the sky over the pampas is usually
- 81–1 clear and sunny.
- 81–2 full of gorgeous colors.
- 81–3 dotted with fleecy white clouds.
- 81–4 gray and overcast.
- 81–5 a deep blue-green.

82. How many different colors are mentioned in the passage? (Count each shade of a color as a separate color.)
- 82–1 Six
- 82–2 Seven
- 82–3 Three
- 82–4 Four
- 82–5 Five

83. The tone of the writer is
- 83–1 gay and confident.
- 83–2 indifferent and colorless.
- 83–3 quiet and restrained.
- 83–4 sarcastic and bitter.
- 83–5 harsh and angry.

84. The last paragraph leaves the reader with a feeling of
- 84–1 cheerfulness.
- 84–2 excitement.
- 84–3 terror.
- 84–4 melancholy.
- 84–5 deep personal sorrow.

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People who take cold baths all winter seldom have colds; but they have cold baths.

85. This sentence implies that cold baths
- 85–1 should be taken by everyone.
- 85–2 should not be taken by anyone.
- 85–3 will cure colds.
- 85–4 are preferable to colds.
- 85–5 are as unpleasant as colds.

86. It is likely that the writer
- 86–1 has found cold baths effective.
- 86–2 has found cold baths ineffective.
- 86–3 usually takes cold baths.
- 86–4 enjoys cold baths.
- 86–5 sometimes has colds.

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Go on to the next page.

(1) It seems to me that true love is a discipline, and
(2) it needs so much wisdom that the love of Solomon
(3) and Sheba must have lasted, for all the silence of
(4) the Scriptures. Each lover divines the secret self
(5) of the other and, refusing to believe in the mere
(6) daily self, creates a mirror where the beloved sees
(7) an image to copy in daily life.

87. The writer thinks the love of Solomon and Sheba must have lasted because

87–1 the Scriptures say it did.
87–2 the Scriptures say nothing to the contrary.
87–3 they were disciplined.
87–4 they were very wise.
87–5 they were Biblical characters.

88. The word "discipline" (line 1) is used to mean

88–1 self-inflicted punishment.
88–2 an instrument of punishment.
88–3 training that perfects and strengthens.
88–4 a rule or system of rules affecting conduct.
88–5 subject for careful study.

89. "For all" in line 3 means

89–1 for the sake of.
89–2 to bring about.
89–3 as shown by.
89–4 because of.
89–5 in spite of.

90. The writer believes that a true lover tends to

90–1 become like his loved one's conception of him.
90–2 become like his loved one.
90–3 develop a secret self.
90–4 think that his loved one is like him.
90–5 hide his loved one's faults.

* * * * * * * * *

If you finish before time is called, check your work on any part of this test.

APPENDIX D

IPAT

Test of "g": CULTURE FAIR

Scale 2, Form A

Prepared by R. B. Cattell and A. K. S. Cattell

Name _____ Sex _____
First Last (Write M or F)

Name of School (or Address) _____

Today's Date _____ Grade (or Class) _____

Date of Birth _____ Age _____
Month Day Year Years Months

Test	Score	Remarks
1		
2		
3		
4		
		Total Score

M. _____

Q. _____

Do not turn the page until told to do so

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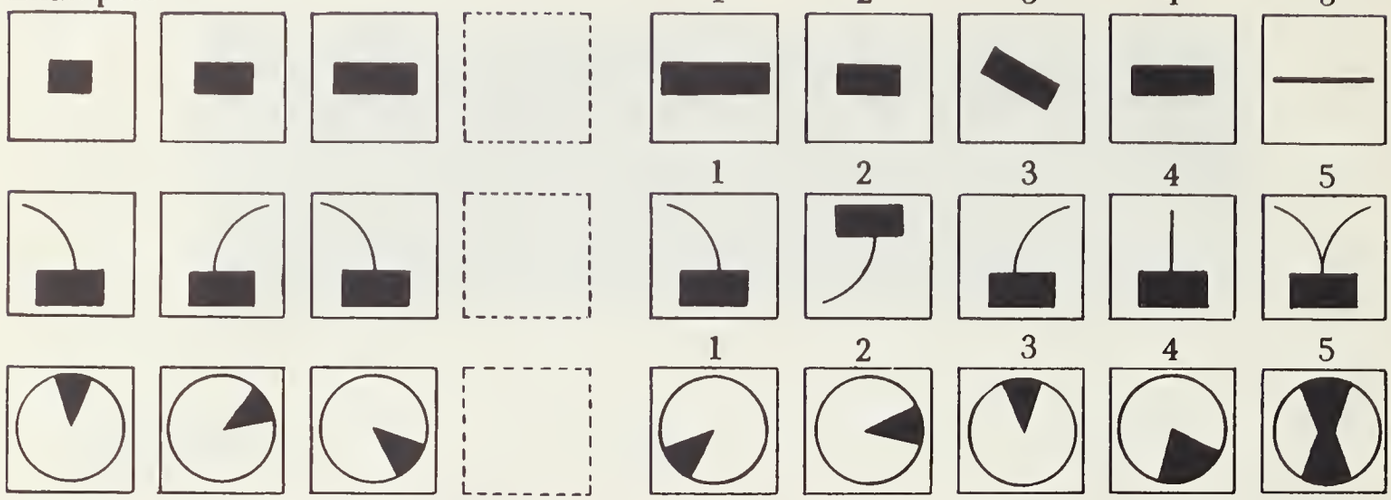
TEST 1

Examples



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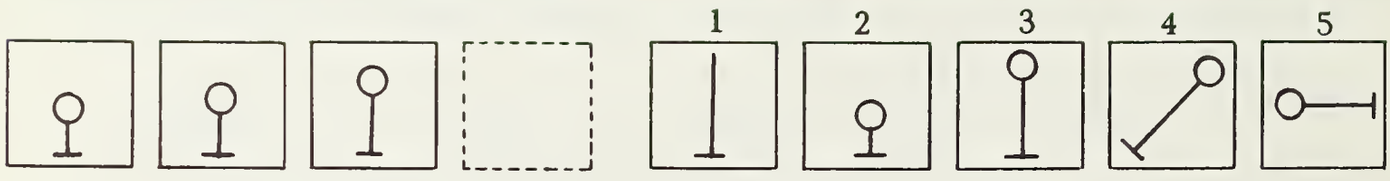

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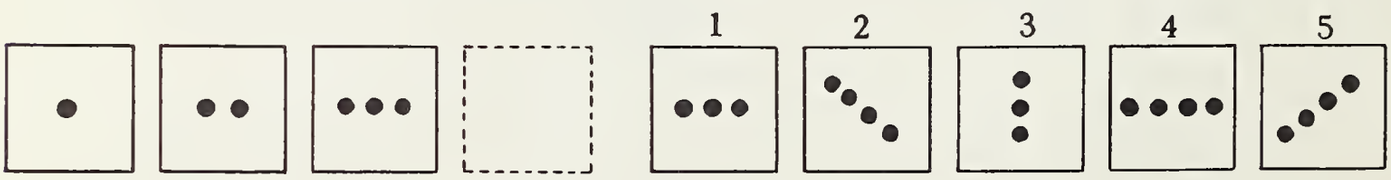

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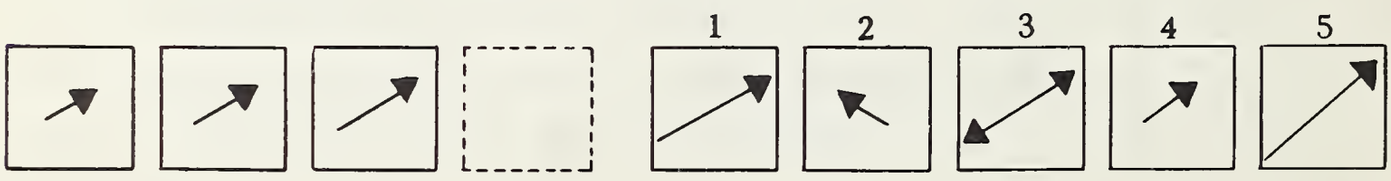

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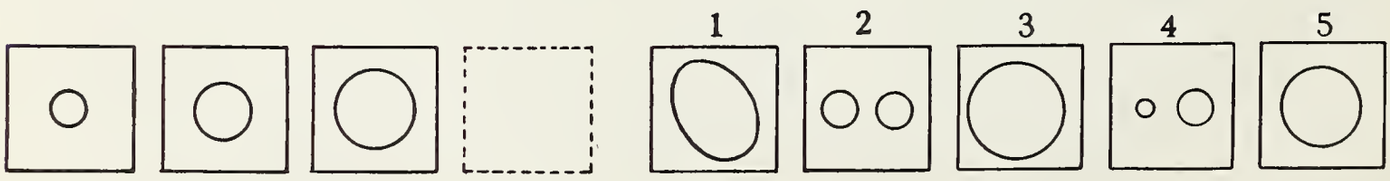

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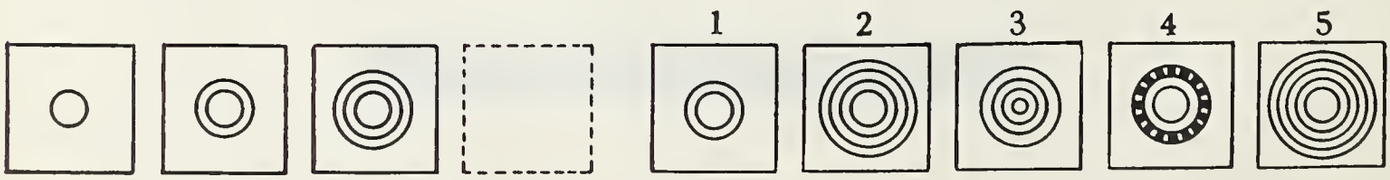

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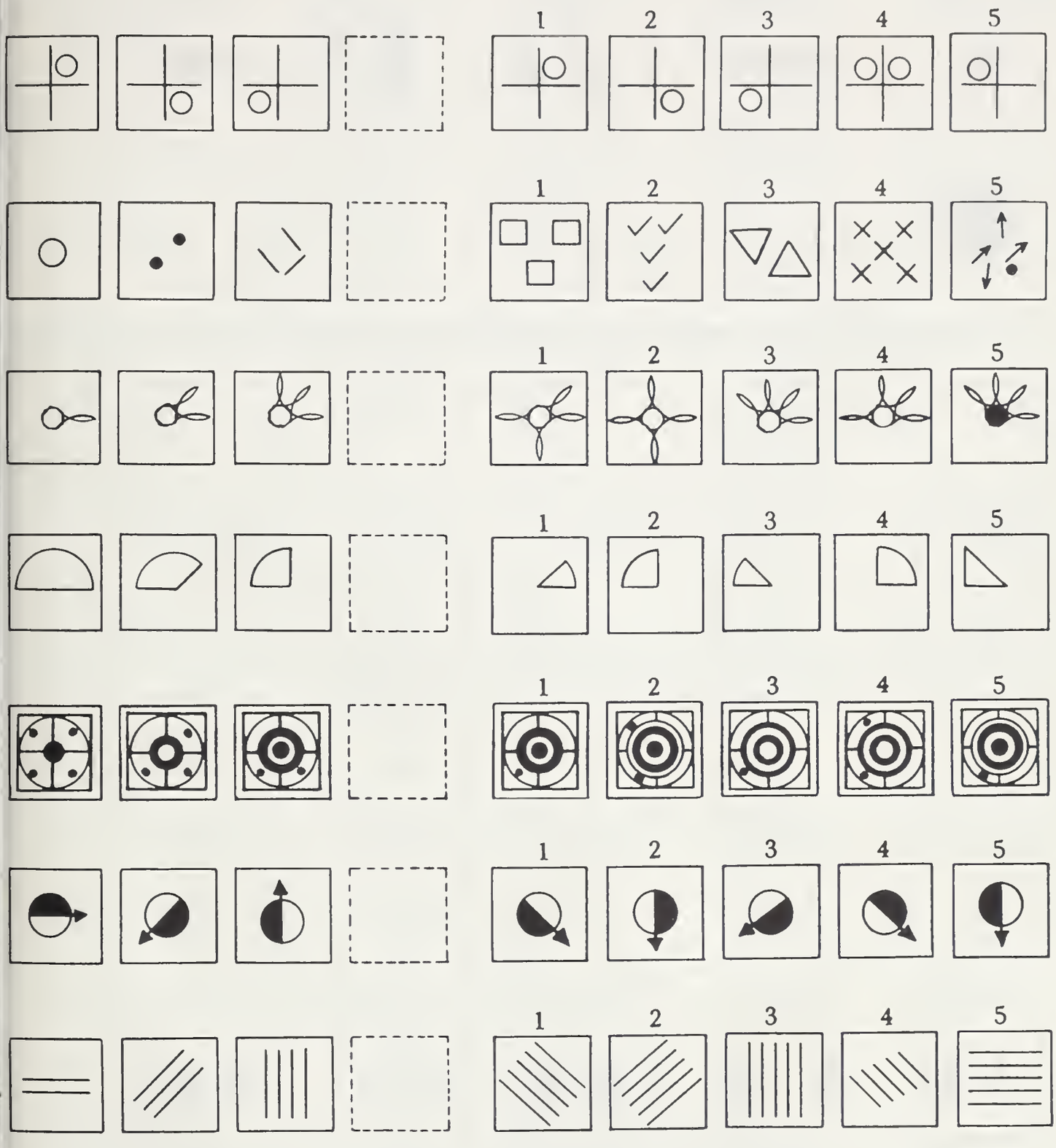


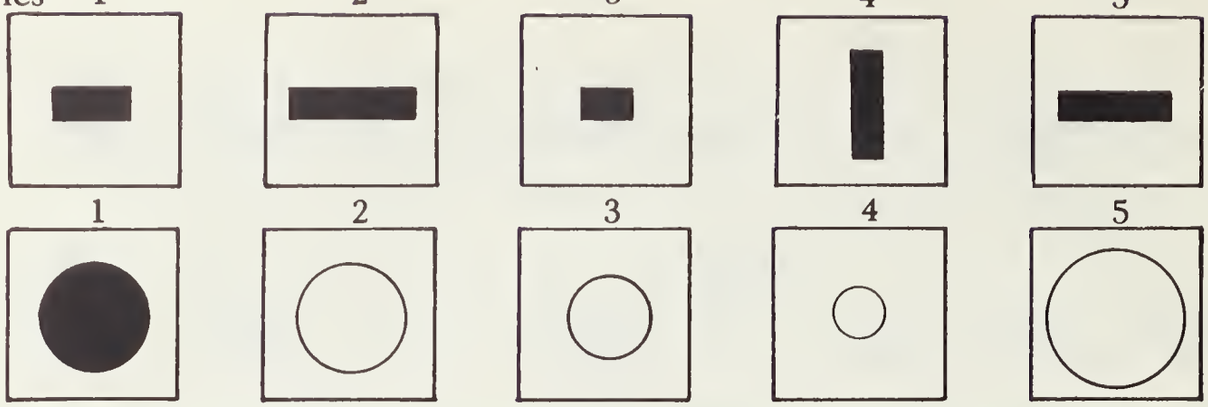
Answer

End of Test 1

STOP! Do not turn the page until told to do s

TEST 2

Examples



Answers

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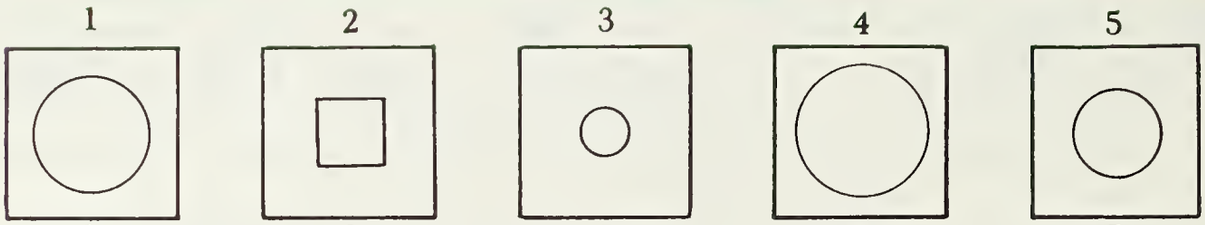

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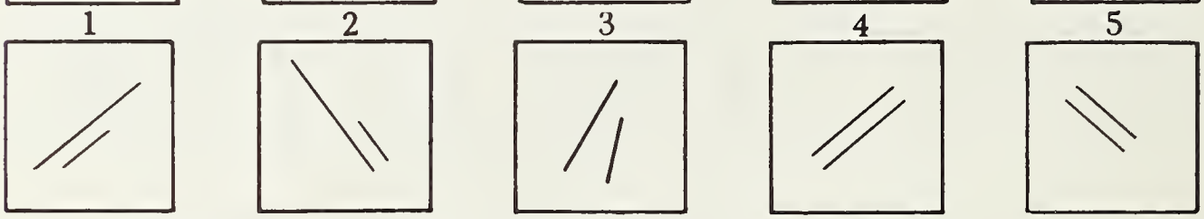
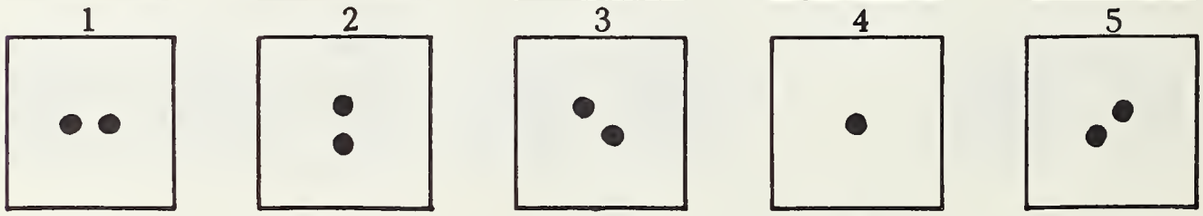


3.



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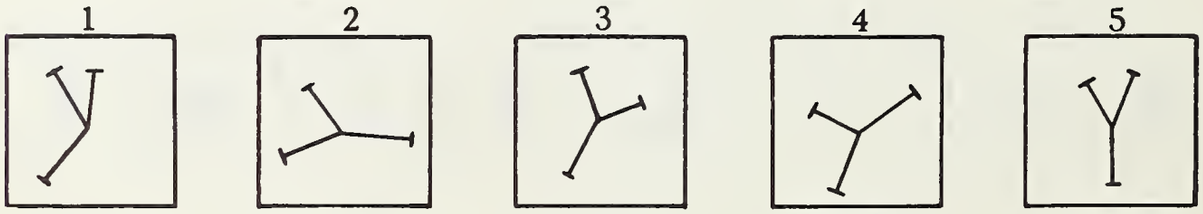

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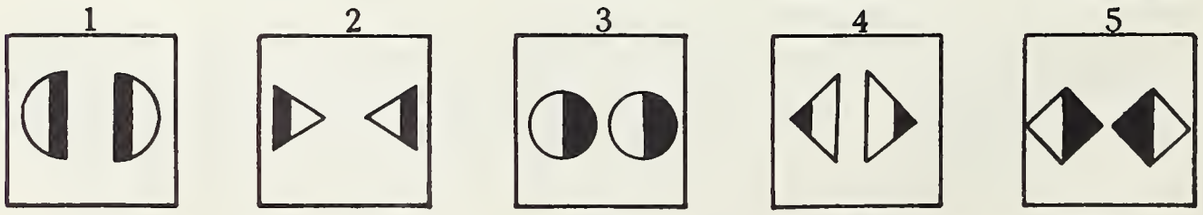

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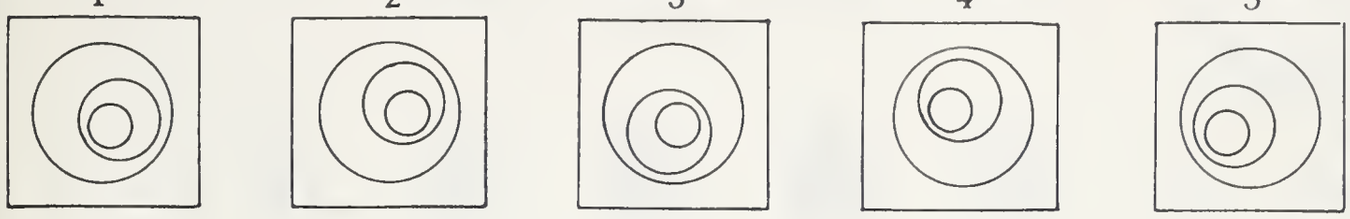
Answers

7. 1 2 3 4 5

8. 1 2 3 4 5



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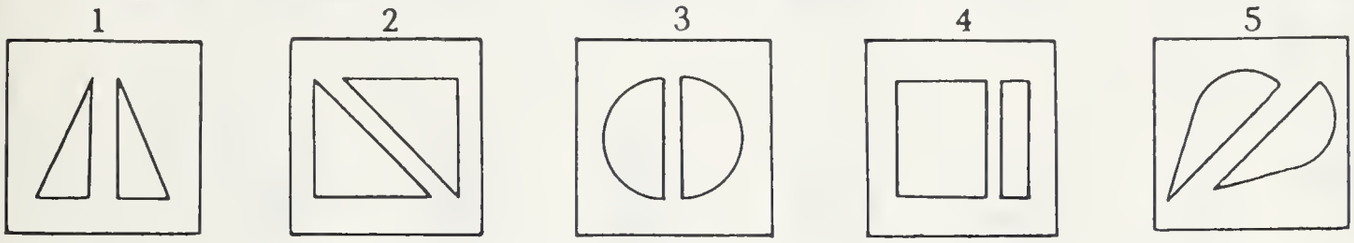

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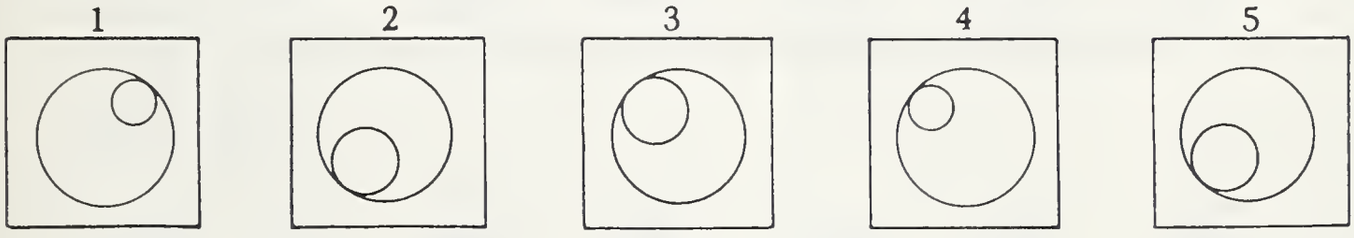

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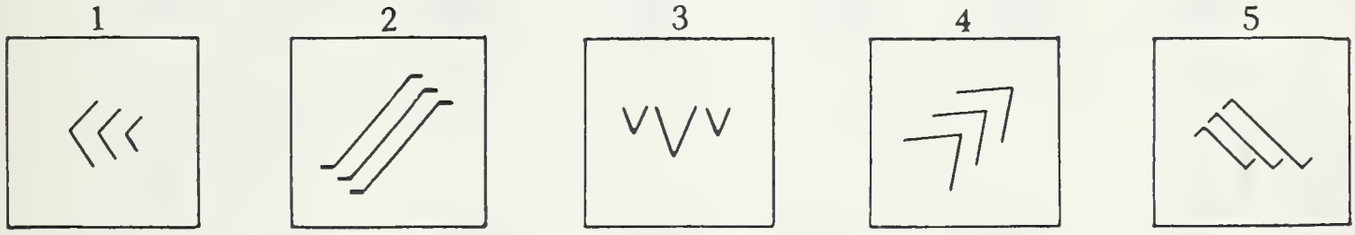

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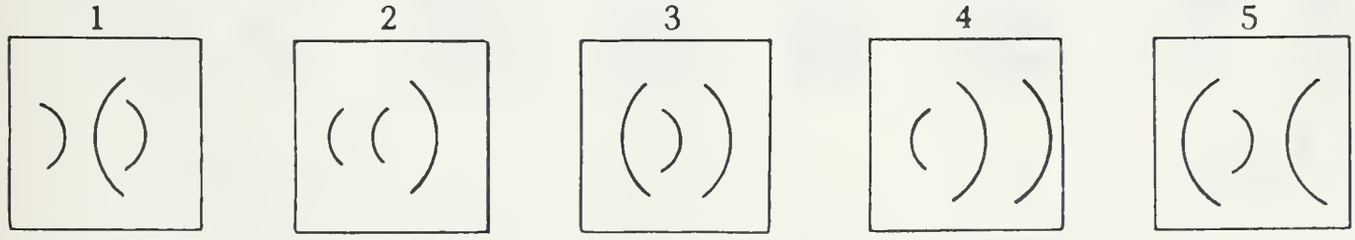

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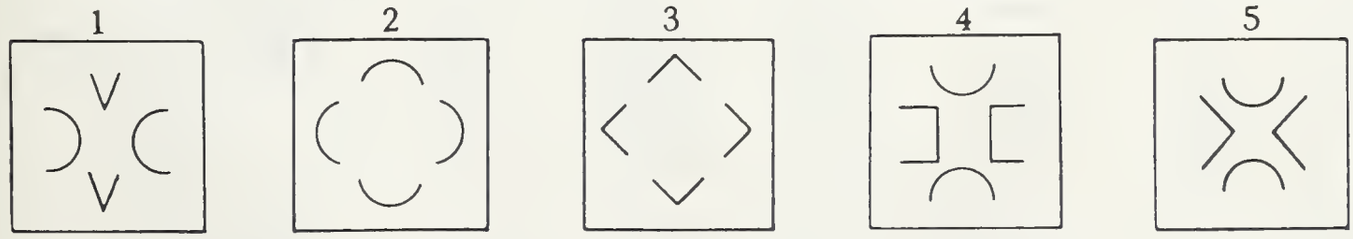

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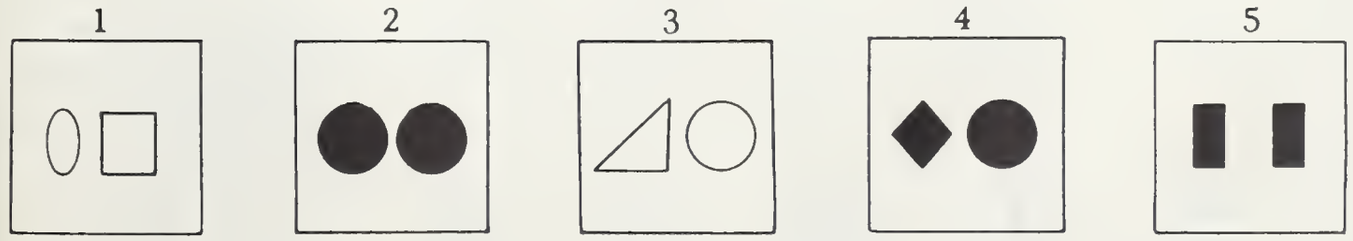


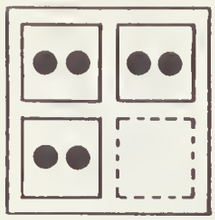
End of Test 2

4.

STOP! Do not turn the page until told to do so.

TEST 3

Examples



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Answers

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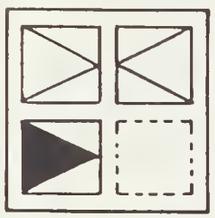

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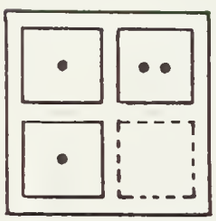
1. 

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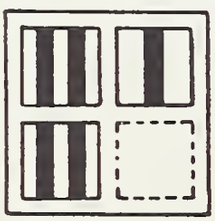
2. 

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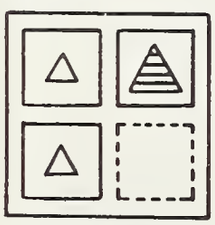
3. 

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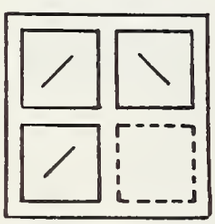
4. 

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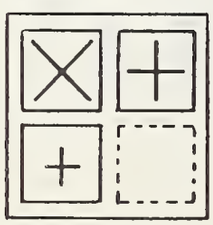
5. 

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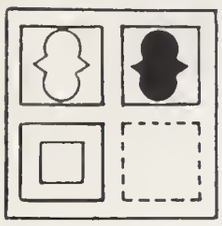
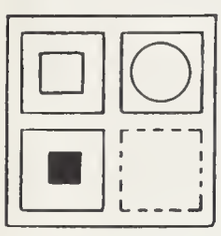
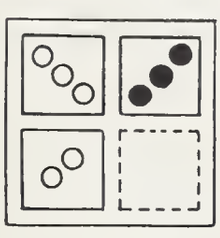
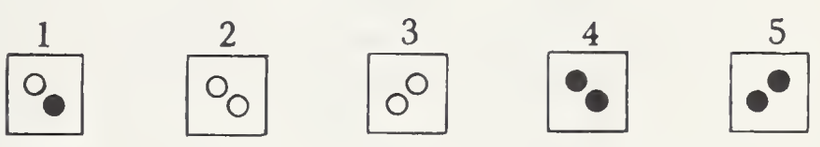
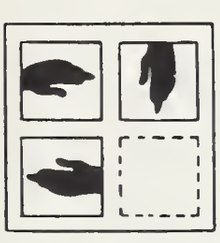
6. 

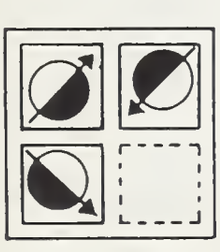
Answers

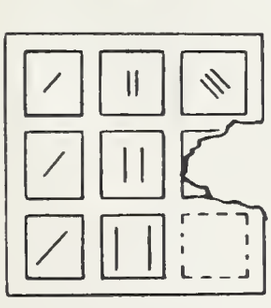
7. 

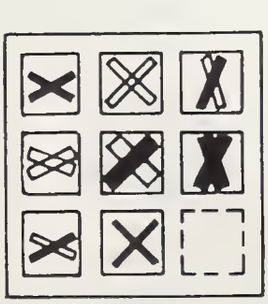
8. 



9. 

10. 

11. 

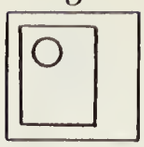
12. 

End of Test 3

STOP! Do not turn the page until told to do so.

TEST 4

Examples

1 2 3 4 5 

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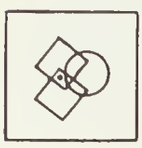
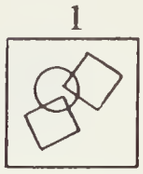
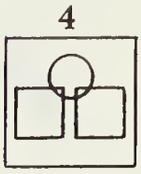


1  2 3 4  5

Answers

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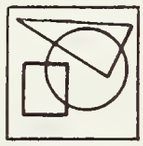
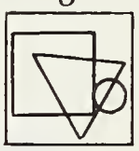
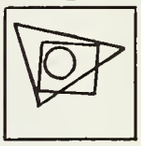
1  2 3  4  5

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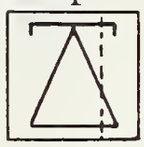
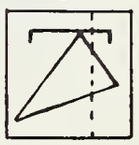
1  2 3  4 5

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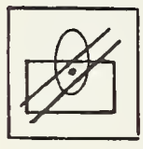
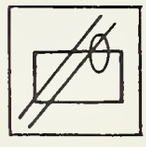
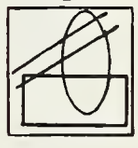
6. 

1  2  3 4 5

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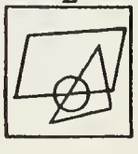
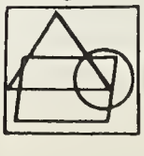
1 2  3 4 5 

End of Test 4

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